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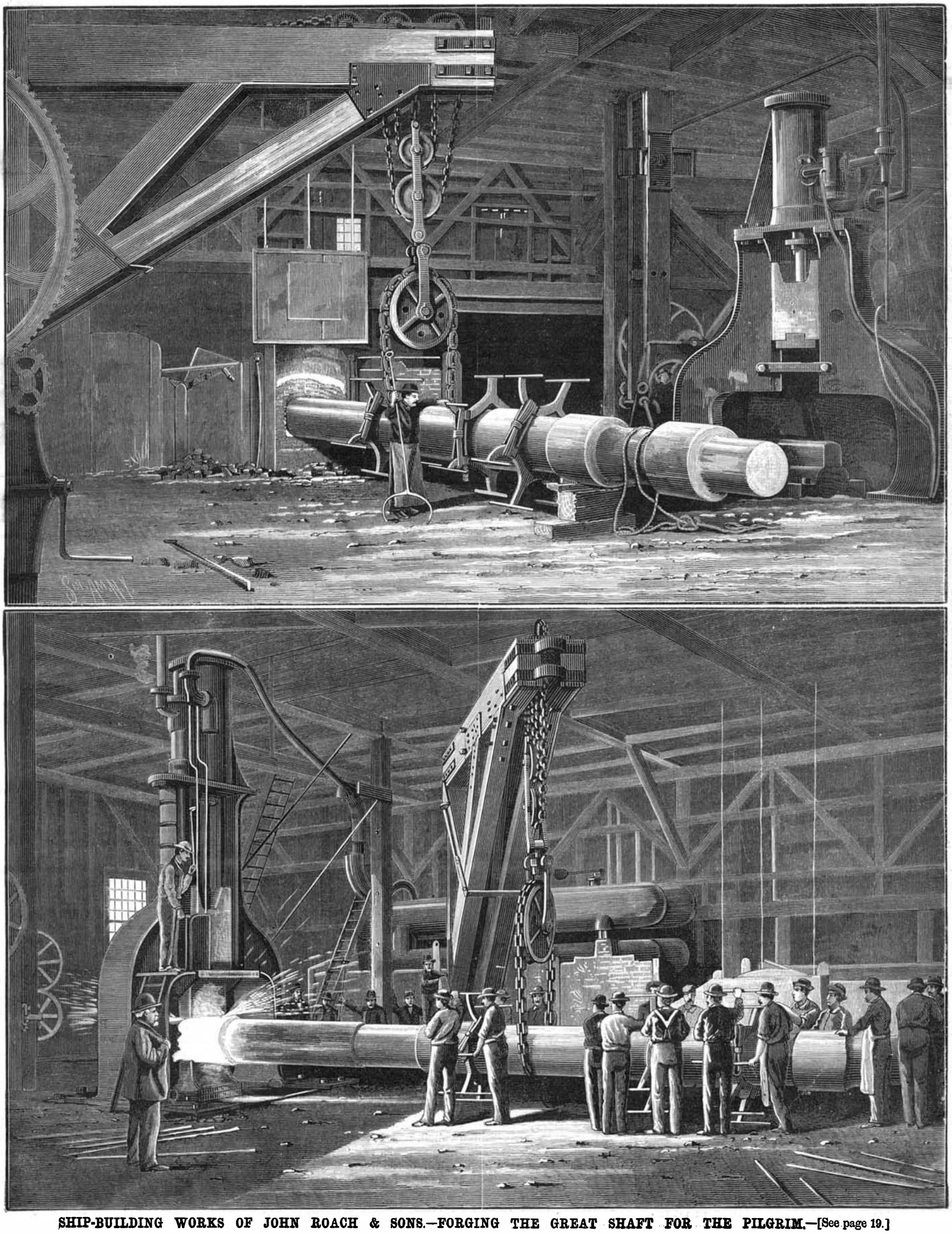

SHIP-BUILDING WORKS OF JOHN ROACH & SONS.—FORGING THE GREAT SHAFT FOR THE PILGRIM.—[See page 19.]

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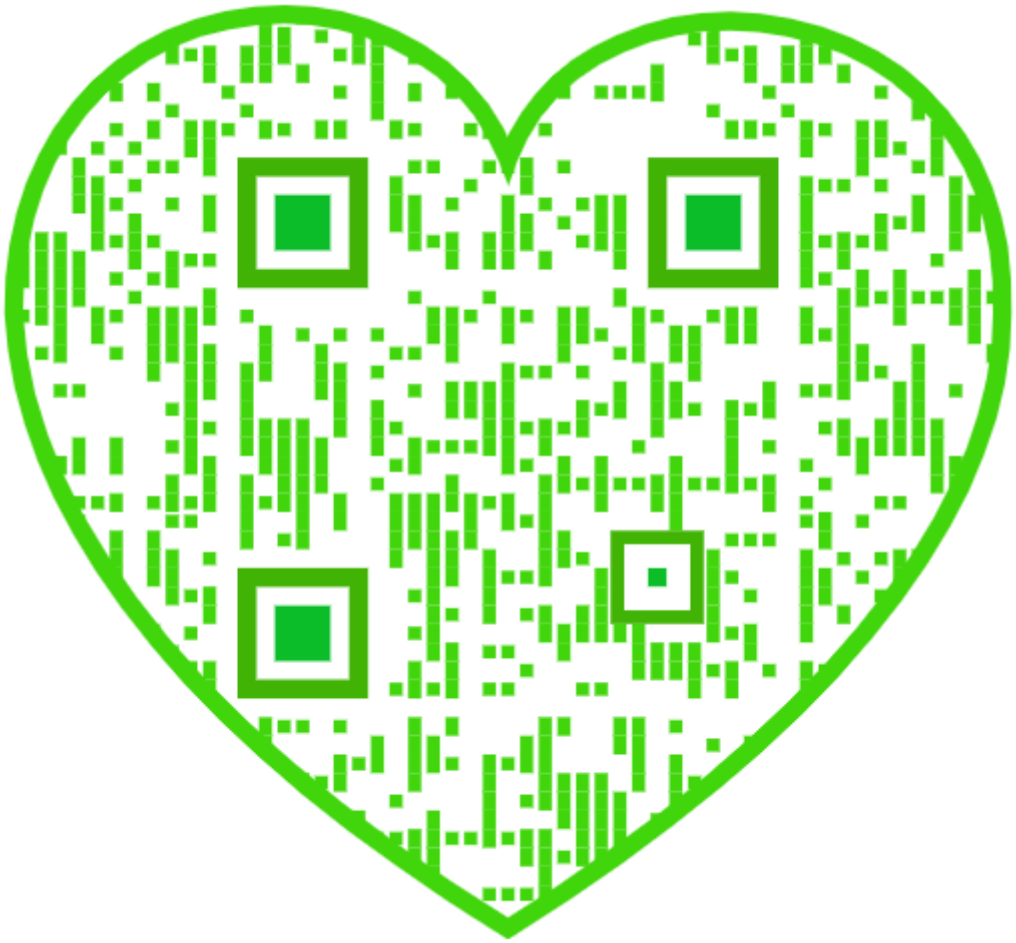

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NEW YORK, SATURDAY, JULY 8, 1882.

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THE SLAUGHTER OF RAILWAY MEN.

At the recent meeting of the Master Carbuilders' Association, Mr. Forney said that from 1,200 to 1,500 railroad employes are killed, and from 5,000 to 10,000 injured, every year.

Curiously the railway train is most dangerous before it leaves the yard, the hazards of the road being slight compared with those of the station.

In his address President Garay said that the present defective and expensive devices for coupling freight cars have been in use for many years without any marked improvement upon the old link and pin system. Although thousands of patents have been granted for improved draw bars and automatic couplers, many of them with some merit, yet none have sufficient advantages to place them in general use.

Though most of the injuries to train men while coupling cars were, he believed, the result of carelessness on their part, it was none the less important that some means should be devised and adopted which would prevent the present risk to life and limb in the making up of trains. What was wanted was an automatic coupler, dispensing with the use of loose links and pins, and at the same time admitting of their use when needed.

The committee on automatic couplers and drawbars reported that out of the 3,000 patents issued for devices of this sort they were unable to select and recommend one as a standard. The implication was that though some of the inventions were good there was none that satisfactorily met all the requirements of the case.

Whoever will watch the making up of trains in any large and busy yard will soon see abundant occasion to charge the yard-men with recklessness. It would be a harder task to discover how, under existing conditions, the work could be done without a constant running of risks that to a cautious onlooker would seem little less than foolhardy. So long as men have to go between cars to couple them they must be reckless—as a soldier is "reckless" who, in the discharge of his duty, exposes his person to the shots of the enemy. It is a problem for inventors to solve to furnish the means for obviating this great hazard to yard-men; and it is the business of railway officials to promptly put to practical test every device that seems reasonably well calculated to cure the evil.

Battles which have decided the fate of empires have been lost and won at a smaller cost in life and limb than that reported by Mr. Forney.

The urgent need of a better state of things has already made itself felt in legislative assemblies, and inventors may rest assured that the railway companies will not long be allowed to overlook or reject any device which shall meet the requirements of the case, even if they should be disposed to do so. The slaughter is too great to be tolerated in the face of a reasonable prospect of cure.

It is needless to add—what must be apparent to the dullest—that the patent for a successful coupler and drawbar would be an exceedingly valuable property.

EMPLOYMENT FOR THE IDLE.

The appearance of Sir John Lubbock's book on "Ants, Bees, and Wasps," suggests the query why books of this character are so rarely produced by our fellow-countrymen. Lubbock devoted ten years or more to the accumulation of the facts that make the book so valuable. It cannot be that Americans are so deficient in the powers of observation that none can be found competent to watch "the busy bee improve each shining hour," and gather facts sweeter than their honey from every tiny insect. It is generally said that we are too busy and that it "don't pay." Are we too busy for polo, and do intercollegiate boat races pay? It is too true that scientific investigation is dependent upon wealth. Had Lubbock been a poor man, compelled to earn his daily bread, he could not have given his days and his nights to the study of ants, simple and inexpensive as were his apparatus and materials. Much may be learned of the habits of birds or insects by an occasional glance at them in spare hours, but study, to be of scientific value, must be close and persistent, to the exclusion of many other things. Few who are competent feel that they can afford this. Among the hundreds that go forth annually from our scientific schools there must be a few endowed with talents for observation, but more lucrative positions await them. The average "graduate" counts his time worth at least $1,000 the first year, $1,200 the next, and so on. Is he wrong in doing so? He has devoted the four best years of his youth to it, he has expended a large sum of money, he has exhausted his own inheritance, and is, perhaps, in debt for his education. Such is the condition in which many a scientific graduate finds himself at the moment of taking his degree. He really *can't afford* to devote himself to unprofitable work—unprofitable from a money point of view. He is not yet a Lubbock or a Darwin. He must serve a long apprenticeship, retracing old and well-worn paths, before he is able to explore a new one. Too rarely has his power of observation been cultivated while under the care of instructors, who have had to content themselves with cooking mental pabulum and setting it before the hungry students, who bolt it, unmasticated, into their overloaded heads (more often merely into their note books), and who go forth from the halls of learning praising the skill of their cooks, and unaware that they are foreordained victims of mental dyspepsia.

Fortunately our Government, like many others, is opening the door for a few real students, whether college men or not, to pursue their bent by giving them a sort of apprenticeship. Accompanying King, or Gilbert, or other explorers of Western wilds, are young men who are having their wits sharpened and their powers of observation trained in a rough but practical school. Their expenses are paid, and they have no care but to do their whole duty.

But there are other fields of study nearer home, fields that the Government cannot undertake to cultivate, the insect world being one of the most fascinating. Who will essay to do for our country, and for some of our insects, what Lubbock has done for ants abroad? The field is not exhausted, and no domain is barren if properly cultivated. We have a wealthy, idle class, less idle than the English it is true, but men who have no need to labor with hand or head, and who are free from every care. To-day hundreds of young men are scouring the forests of the Adirondacks, or shooting the rapids of the St. Lawrence, not in search of "one impulse from the vernal wood," but impelled by fashion, and boring themselves to death because it is "quite the thing you know" to rusticate. Here is the material from which the ranks of unpaid investigators ought to be recruited. Does not Lubbock write M.P. and Bart. and other significant letters after his name? Where is the M. C. that has done as much, and which brings him the more credit and renown, his services in Parliament or his labors among the ant hills? Is investigation likely to lower the dignity of the son of a millionaire?

We have pointed to this as a waste of valuable raw material; men of brains, of leisure, and of means, seeking in vain for some new way of getting rid of the most valuable thing on earth—time. But they are of no use to us or to science; let them finish their days as they have begun, let them listen to a few law lectures that they do not understand, or join some political party and set up for statesmen if they have money enough to buy an office. But shall this thing go on for ever? Is it not possible to cut off, in part at least, the source of supply by turning it to other channels? Many of these young men who have now no thought beyond the morrow, no higher ambition than to color a meerschaum, were boys once, real, genuine, inquisitive boys. Then their powers of observation were capable of cultivation, then a love of nature could have been implanted in their souls, and life would have been brightened by an object, and one worthy of a life-long pursuit. When teachers cease to hold up as models those great men who, like Lincoln and Garfield, have risen from poverty and obscurity to the presidency, and point with pride to the boys who, in spite of wealth and luxury, have had the courage and perseverance to do a noble act by devoting their time, money, and talents (for some rich boys have genius as well as poor ones) to the study of nature, when teachers begin to have common sense, we may hope to see some of this valuable material rescued from its present *downward* course. Rich men are not all fools, and there are some who would take pride in a son who, although he might not be a Leidy or a Lubbock, a Darwin or a Dawson, should be able to associate on terms of scientific equality with men of that class.

Unfortunately few schools exist, probably none, where the nature-loving boy can go that he is not in danger of having that faint spark crushed out of his young soul by the memorizing and cramming process that the marking and grading system necessitates, so that, having studied nature in books, when they go out to look for her they do not recognize her. When and where shall this lack be supplied?

Certainly it may be said that nature is spreading a bountiful harvest, but the laborers are few. Let those who have time, money, and brains, lend a hand, feeble though it may be, in unlocking the secrets of nature.

Curious Electrical Phenomena on Pike's Peak.

Sergeant L. M. Dey, signal officer at the summit of Pike's Peak, writes: "At 8.45 o'clock this evening, on opening the door, a most curious phenomenon met my astonished eyes. The line on the summit was distinctly outlined in brilliant light, which was thrown out from the wire in beautiful scintillations. On near approach to the wire these little jets of flame could be plainly observed. They presented the appearance of little electrified brushes or inverted cones of light—or more properly little funnels of light with their points to the line, from which they issued in little streams about the size of a pencil lead, and of the brightest violet color, while the cone of rays was of a brilliant rose-white color.

"These little funnels of light pointed from the line in all directions and were constantly jumping from point to point. There was no heat to the light, though it was impossible to touch one of these little flames, for as soon as they were approached by the finger they would instantly vanish or jump to another point on the line. Passing along the line with finger extended, these little jets of flame were successively 'puffed out,' so to speak, to be instantly relighted in the rear. It was a curious and wonderful sight. No sensation was experienced on applying the tongue to the line. Not only was the wire outlined in this manner, but every exposed metallic point or surface was similarly tipped or covered. The cups of the anemometer, which were revolving rapidly, appeared as one solid ring of fire, from which issued a loud, rushing, and hissing noise. The wind vane represented a flaming arrow, and a small, round, wooden stake—stuck up in the snow to show the position of the gauge—was similarly tipped, as well as an angle of our stone chimney.

"In placing my hands close over the revolving cups of the anemometer—where the electrical excitement was abundant—

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not the slightest sensation of heat was discovered, but my hands instantly became aflame. On raising them and spreading my fingers, each of them became tipped with one or more beautiful cones of light, nearly three inches in length. The flames issued from my fingers with a rushing noise, similar to that produced by blowing briskly against the end of the finger when placed lightly against the lips, accompanied by a crackling sound. There was a feeling as of a current of vapor escaping, with a slight tingling sensation. The wristband of my woolen shirt, as soon as it became dampened, formed a fiery ring around my arm, while my moustache was lighted up so as to make a veritable lantern of my face. The phenomenon was preceded by lightning and thunder, and was accompanied by a dense driving snow, and disappeared suddenly at 8:55 o'clock, simultaneously with the cessation of the snow. I much regret that there was no one on the Peak to witness the phenomenon with me—it was a wondrously beautiful sight."—*Colorado Springs Republican.*

Remarkable Tornado.

On the 17th day of June, 1882, between the hours of 8 and 9 o'clock P.M., a terribly destructive tornado (or, in more modern parlance, "cyclone") passed from the northwest to the southeast, through a portion of the State of Iowa. We hear of its first movements in the County of Boone, from whence it passed through a portion of the counties of Story, Jasper, Poweshiek, Keokuk, Jefferson, and Henry. It was not only very erratic in its course, but was sometimes divided into two or more branches, which spread a few rods or a few miles apart, only to reunite with redoubled fury at some other point in the line of its course. It did not always visit the earth's surface, but often passed so far above as to inflict no injury, and again would swoop down with relentless fury, carrying death and destruction for a few miles to every animate and inanimate object in its path. It did not move in straight lines. It not only pursued a zigzag course, but also moved upward and downward, and had a circular as well as forward motion at the same time.

The point of its greatest devastation was the city of Grinnell, in Poweshiek County. Malcom, a village of some 300 inhabitants, nine miles southeast of this city, was also nearly destroyed, but with small loss of life.

For a few days previous to the storm the temperature was so low as to excite surprise throughout the State, the mercury varying from 40° to 48° Fahrenheit during the day, and still lower at night. At Grinnell, on Saturday morning, the 17th, the temperature rose rapidly, and at 2 o'clock P.M. the mercury marked 98° in the shade. The air was oppressive and stifling, notwithstanding a gentle breeze was perceptible. After 4 o'clock clouds began to overspread the firmament, presenting a most singular appearance and attracting much attention. They may be described as small in size, light and fleecy in appearance, quite detached from each other in many places, having small dark pendants suspended from their lower portion, and with but slight movement in any direction. Shortly after 6 o'clock dark storm-clouds were seen in the western horizon moving slowly upward toward the zenith, and about which brilliant flashes of lightning played from time to time. The low rumble of distant thunder reached the ear, while directly overhead the small conical-shaped clouds, which had now assumed a still darker appearance, were seen to be in motion and massing themselves together as if for battle. At about 8 o'clock our attention was called to a most singular appearance of the sky a little south of west from Grinnell. It can be best described as like the reflection from the setting sun, yet in this instance such could not have been the case, as it had not only disappeared below the horizon thirty minutes before, but the position of the phenomenon and the mass of dark clouds beyond would render such reflection impossible. It appeared to the eye about ten feet in diameter, circumference irregular, and of a rich yellow hue, partly inclining to red, and emitted a light that was brilliantly reflected through the windows. Its unearthly appearance at such a time created some alarm in many localities. Within the following twenty minutes heavy rain, accompanied by a most weird electric display, heavy peals of thunder, and dense darkness (except when relieved by the lightning), threw the pall of night over every object. The wind, which at first was a gentle breeze, increased to a gale, swaying the trees in every direction. Hail about the size of a pea, and a few weighing one-fourth of an ounce, fell rapidly, but doing little damage.

At twenty minutes to 9 o'clock the dreadful roar that preceded the coming of the destroyer was plainly heard in the northwest. At first a low, sullen roar like Niagara in the distance—then deeper-toned, louder, and faster, as of many approaching railway trains—still nearer, mingled with an awful, never-to-be-forgotten hum, as of wheels and pulleys in motion, until the listener, with blanched face, fled in terror for a place of safety. Hundreds sought refuge in cellars and caves, and were thus saved from death, *one only* being killed who had taken this precaution. The point of observation of your correspondent was about 900 feet from the line of the greatest destruction in Grinnell.

The inky darkness of the hour shut out from human eye the scenes of anguish and the greater part of the appalling work of destruction, in which the elements were engaged, yet one or two buildings nearly entire, were seen high in the air for an instant as the vivid flashes illumined the awful scene.

The storm-cloud proper entered the city from the southwest, first striking the earth on the north side of the C. R. I. and P. R. R. This terrible "reaper of death" cut a swath through densely populated portion 700 feet in width in the average, and did not probably exceed five minutes in passing through the city, but in that limit of time forty human beings were instantly killed, and at least ten more will die of their injuries. From fifty to sixty buildings (the Iowa College buildings included) were also totally destroyed—in most instances broken into small fragments and thrown in all directions.

Two heavy freight trains, entering the city from the north and east, were caught up and dashed upon both sides of the track with terrible violence. Even the ponderous engine was lifted bodily upward, but came down upon its wheels again without injury. The distance traversed by this tornado from Boone to Henry County is in a direct line about 145 miles, although its circuitous route was probably 200.

It appears to have been between three and four hours in travelling this distance, and caused the death of seventy-five or eighty people, a still greater number of animals, and destroying property valued at nearly two millions of dollars.

Several peculiarities of this tornado may be worthy of record. Water, in immense volume, accompanied it. Electricity in form dynamic and thermal played an important part. Balls of electricity were frequently seen, and window-glass was melted in circular form and with sharply defined borders. Light objects were carried upward, apparently to a great height, and thence at almost right angles with the course of the tempest, found on the ground thirty and forty miles distant.

Unlike the tornado of 1860 in this State, no fetid or sulphurous smell was perceptible, nor did the dead bodies present such a blackened appearance, and wounds seemed to heal more rapidly. There seems to have been a series of almost constant rain and wind storms in this State, and as far south as Missouri and Kansas, since the 17th and up to the date of this communication.

FRANK A. HOWIG.

Grinnell, Iowa, June 26, 1882.

Remarkable Wave on Lake Erie.

The southern shore of Lake Erie was struck by a remarkable wave on the morning of June 23. Much damage was done at Cleveland. The signal officer at that point heard distant thunder at 6:10, and looking northward over the lake saw a heavy thundercloud overhanging the water. Above it was a contorted, angry looking conglomeration of clouds, and north of it a large stratus cloud. It moved very rapidly, and at 6:20 A.M. the wave struck the shore. When first noticed the wave was about a quarter of a mile from shore, and appeared like a green wall ten feet high. The lake had been calm, and this was the first disturbance of its surface. The wave swept along rapidly and silently until it reached shallow water, when it made a loud, swashing noise, and broke on the shore with a great roar. The wave reached from north-north-east to south-south-west. After it had struck the shore two recoil waves followed close together. At 6:35 A.M., a quarter of an hour after the wave had reached the shore, a shower began, which lasted for fifteen minutes, during which two one-hundredths of an inch of rain fell. No high wind was perceptible, although slight squalls on the lake were reported by incoming vessels.

Gold and Silver Plated Flowers and Insects.

At a recent meeting of the Physical Society, Berlin, Prof. Christiani exhibited as samples of a new method of preservation a series of organic bodies coated galvanoplastically. A mulberry leaf, a crab, a butterfly, a beetle, the brain of a rabbit, a rose-bud, and other objects, were plated with silver, gold, or copper, and showed all details of their outer form, down to the finest shadings. As to the process, it was stated that the objects to be preserved being put into a solution of silver nitrate in alcohol, then dried and treated with sulphureted and phosphureted hydrogen, form good conductors, which, brought in the usual way into the galvanoplastic bath, can be coated with any desired thickness of a metallic deposit.

Magazine Guns.

The Magazine Gun Board now in session at the Armory Building, New York, have decided not to receive any models of guns for examination test after July 15, at which time the supplementary tests of the guns already received will begin, and the real work of selecting one or more guns for trial in the service will be inaugurated. It is understood, says the *Army and Navy Journal*, that thirty-three different models have been tested by the board, and there are five or six more still on the dock, and there seems to be a fair prospect of getting a good arm for the service. The board, as the result of their experiments, have, we understand, reached the conclusion that a carbine cartridge, with 50 grains of powder, will shoot a bullet farther than a cartridge with 70 grains of powder.

THE marvelous durability of mortar in Italy is attributed by the London *Builder* to the fact that the lime remains in a pit covered with water for two years before it is used, whereas in England lime is slaked and used the same day. Most building specifications even require newly slaked lime.

Ten Years' Agricultural Progress.

A special census statement contains the following agricultural aggregates: The value of the products of agriculture had not been computed, nor the value of the hay crop for 1879 (the census year's crop). The wool statement does not include that grown on public lands and ranches, nor that in hands of butchers, etc., 100,000,000 pounds.

	1880.	1870.
Land in farms in acres	539,351,713	407,735,041
Improved land in acres	287,220,321	188,921,099
Value of farms	$10,197,161,905	$9,262,803,861
" farm implements	$406,522,414	$336,878,429
" farm animals	$1,500,503,807	$1,525,276,457
" farm products	.....	$2,447,588,658
Horses	10,357,981	7,145,370
Mules and asses	1,812,932	1,125,415
Working oxen	993,970	1,319,271
Milch cows	12,443,593	8,935,332
Other cattle	22,488,590	13,566,005
Sheep	35,191,656	28,477,951
Swine	47,683,951	25,134,569
Corn in bushels	1,754,861,535	760,944,549
Wheat "	459,479,505	287,745,626
Oats "	407,858,999	282,107,157
Rye "	19,831,595	16,918,795
Barley "	44,113,495	29,761,305
Buckwheat "	11,817,327	9,821,721
Cotton in bales	5,746,414	3,011,996
Hay in tons	.....	27,316,048
Wool in pounds	155,685,750	100,102,387
Butter "	777,204,471	514,092,683

No Atmosphere in the Moon.

At a recent meeting of the Photographic Society of France, M. Janssen handed round a magnificent proof of the late partial eclipse, and said a few words upon the long discussed question of a lunar atmosphere. In speaking upon this subject he said: "Suppose for a moment that the moon is surrounded by an atmosphere, what would be the result if we took a photographic view of it during an eclipse? The lunar disk would be sharp enough, but there would be a gradual decline in density, as in a vignetted portrait. This is exactly the contrary which took place, as the proof will show. The lunar disk is very sharp, and the negative is rather intensified near the disk, probably from refracted light." M. Janssen appears to doubt the existence of a lunar atmosphere.

Steam on Street Cars.

After the most faithful efforts of the managers of the street cars in Paris to substitute steam power for horses, they have given up the job. For five years they have used steam, during which period they tried twenty-one different forms of engines. The companies now discard steam and return to horse flesh as on the whole the safest, most economical, and most satisfactory. It would seem as if the experience ought to be of value to inventors; that they can and will ultimately overcome every difficulty there can be no doubt. Who will win the prize by the invention of a steam street car that will successfully compete with animals?

The Growth of Coral.

After a cruise of a few months in the South Pacific, a French man-of-war was recently found to have specimens of living coral growing upon her hull. This interesting discovery has thrown some light on the question of the rapidity of growth of coals. The evidence tends to show that the vessel on passing a reef of the Gambier Islands, against which it rubbed, had picked up a young fungia, which adhered to the sheathing of the ship, and grew to the size and weight it had when observed, a diameter of 9 inches, and a weight of 2½ pounds, in nine weeks.

Bean Disease.

The early French beans in Algeria have been extensively affected this year by a disease unknown before, at least in these crops. It attacks stems, branches, leaf stalks, and fruits; which acquire a white covering, in some parts like tufts of wadding, this being the mycelium of a parasite fungus, which also deeply invades the bark, and sometimes penetrates to the pith. M. Prillieux finds some evidence that the same disease attacks other plants of very different nature—as clover and hemp.

Over 400 Miles a Day.

The Guion steamer Alaska has again beaten her best westward record. She left Liverpool June 17, and Queenstown at noon the next day. She arrived at Sandy Hook at 9:45 on the morning of the 25th, her corrected time for the run being 7 days 1 hour 50 minutes. On the 22d the distance run was 430 miles. The average for the trip was over 400 miles a day.

The Carrying Capacity of Freight Cars.

It is only a few years since freight cars were allowed to be loaded with more than ten tons. Now but few eight-wheel cars are built with a carrying capacity of less than twenty tons. The advantages and economies secured by increased capacity are such that a committee of the master car builders' association have recommended the building of twenty-five or thirty ton test cars, believing that freight can be carried in thirty ton cars with as much safety and with greater economy than in cars of less capacity.

To stain a glass lamp chimney paint the glass with a solution of waterglass (sirupy) stained with chrome green, and let it dry thoroughly before using on the lamp.

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Migration of Fish.

Dr. Keller, in a communication sent to the Swiss Geographical Society, from Suez, gives some interesting points on this subject. In the twelve years that have elapsed since the opening of the Suez Canal, the interchange of animal life between the Mediterranean Sea and the Indian Ocean has not reached the dimensions at first anticipated, still a number of smaller fish have found their way from the Mediterranean to the Red Sea. A greater desire to travel in this direction than in the opposite one seems to prevail. A very interesting fact has, however, been established, namely, that the real pearl oyster are traveling through the canal, not a few straggling outposts, but large trains moving regularly along. As they have not yet reached the Timsah lake, it will be one or two decades before they will be established in the Mediterranean.

THE BINARY INJECTOR.

The accompanying engraving illustrates a somewhat curious injector made by Messrs. Weild & Co., Gorebrook Ironworks, Longsight, Manchester. It was for a long time a puzzle how an injector working under a given pressure could force water into a boiler in which there was a still greater pressure, but the Binary injector does more than this, for the exhaust steam from an engine is made use of to feed the boiler with water.

The section which we give will make the interior of the instrument intelligible. The theory of the action of the injector we give as stated by Messrs. Weild. The injector is not perceptibly intermittent in its action, although the exhaust from the engine comes in puffs. The pressure of the steam cannot be less than about 18 lb. absolute, and this, coming in contact with the feed, is condensed, and the velocity of influx of the steam to the injector is thus very high.

Between the blasts or puffs the reciprocation of the piston expels the residual steam or vapor, which must, in the cylinder of a non-condensing engine open to the exhaust, necessarily equal the atmospheric tension. The continual supply and condensation of such steam provides, without intermission, a propulsive energy sufficient to introduce the feed-water under ordinary pressures, as we conceive the following rough calculation will tend to show. Friction neglected, steam of 14·7 lb. per square inch, or 2,118·4 lb. per square foot, absolute pressure, will flow into a vacuum of 10 lb. per square inch below the atmosphere, which corresponds to an absolute pressure of 4·7 lb. per square inch, or 676·8 lb. per square foot, with a velocity

$$=8\sqrt{\frac{2118\cdot4-676\cdot8}{0\cdot0378}}$$

$=1{,}554\cdot8$ ft. per sec.

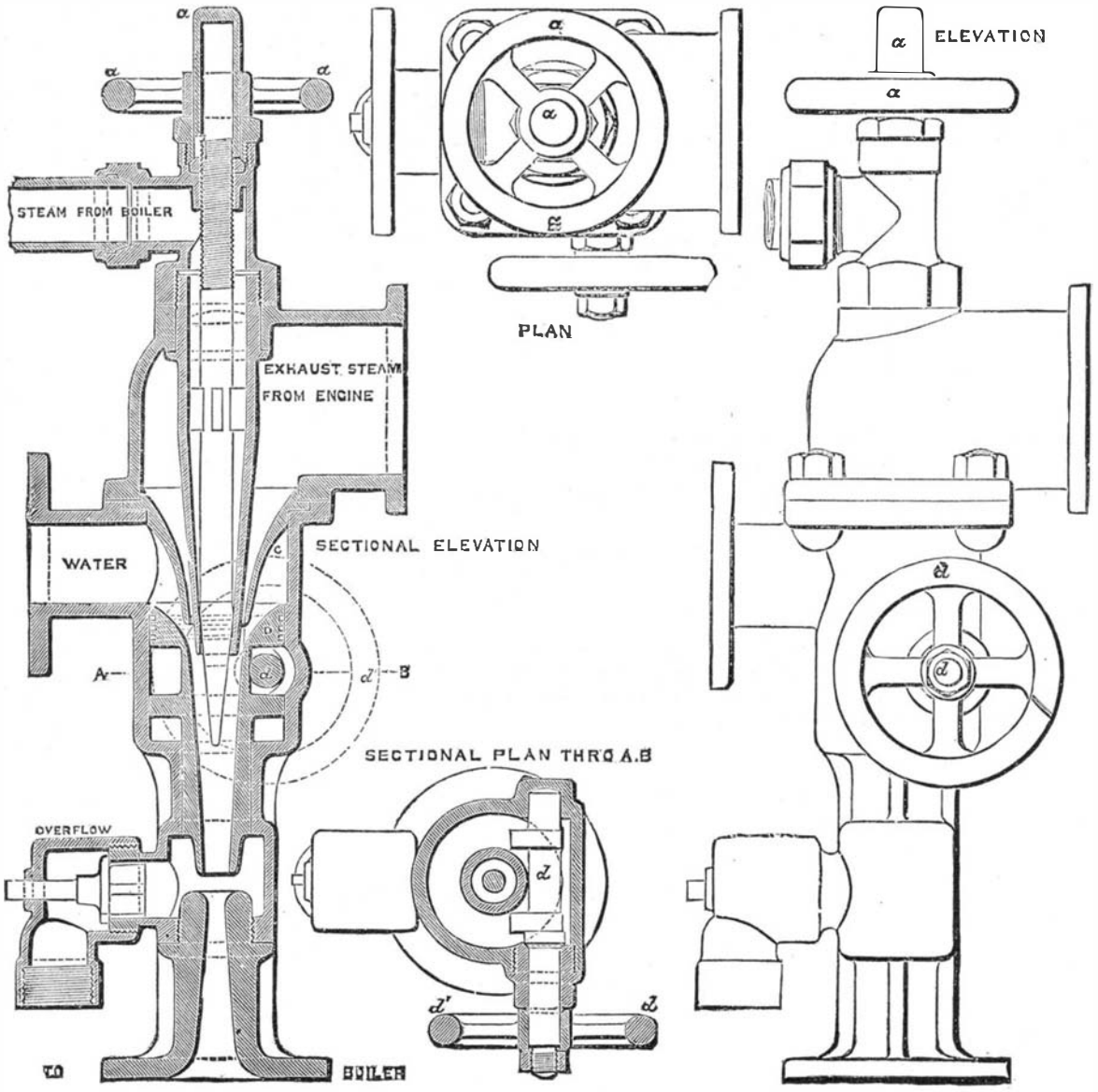
The head of water requisite to balance a pressure of 75 lb. per square inch above atmosphere

$=75\times2\cdot25=169$ ft.

nearly. Velocity of efflux under such head

$=8\sqrt{169}=104$ ft.

per sec. Suppose each pound weight of steam of atmospheric tension propels 12 lb. of water and is thereby condensed, the equivalent resultant velocity will be $\frac{1{,}554\cdot8}{113}=119$ ft. per sec.; this is equal to a head of 219 ft., or a pressure of 97·5 lb. per square inch. If the original temperature of the water be 50°, the resultant heat at which the feed leaves the injector will approximate 149°. The injector has been doing excellent work wherever it has been fitted.



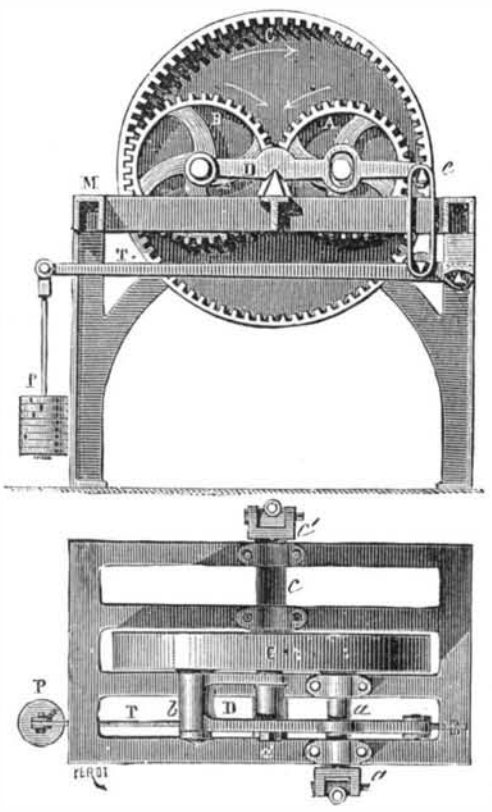
THE BINARY INJECTOR.

New Jersey Glass Blowers.

According to a table compiled from replies to a letter of inquiry sent by the New Jersey Labor Bureau to the glass blowers at home and abroad, the average yearly earnings of glassblowers in New Jersey is from $1,064 to $1,080 per annum according to the kind of work done. One glassblower, who lost twenty days during the year, reports that he received $1,350 in wages. An English workman on the same kind of goods reports his income for the year at £120, or about $583. His hours of employment ranged from eight in the slack to ten during the busy season; that of the American workman from eight and a half to nine hours per day.

RAFFARD'S TRANSMISSION DYNAMOMETER.

The annexed cut represents a new transmission dynamometer, that is to say, an apparatus for measuring the power expended by machine tools. The motor acts directly upon the axle of the wheel, A, in the direction shown by the arrow, and this wheel carries along the intermediate one, B,



RAFFARD'S TRANSMISSION DYNAMOMETER.

which transmits motion to the inner-toothed wheel, C. The latter is connected with the tool to be experimented upon by the axle, c, and the Cardan joint, c'. The axles, a' and c', revolve in bearings fixed to the frame, M, but the axle of the wheel, B, revolves in a bush which is carried by a beam whose fixed axis passes exactly through the contact of the primitive circumferences of the wheels, A and B. The result of this is, that the momentum of the force exerted by the wheel, A, upon B, is null with respect to the edge of the knife-blade upon which the beam oscillates, and that, consequently, such force has no tendency to move the beam in one direction more than in another. The beam, then, is only influenced by the resistance that the wheel, C, offers to the motion of the wheel, B; and it is such resistance that, by a system of levers in a ratio of 1 to 10, is measured by means of the weight, P.

In order to simplify calculations the primitive circumference of the wheel, C, is made equal to 3 meters. The formula of the work then becomes very simple: $T=\frac{P\times10\times3\times n}{60}=\frac{P\,n}{2}$, in which T is the work per second, P the weight situated at the extremity of the lever system, and n the number of revolutions per minute.

It should be remarked that this dynamometer will permit of obtaining results that are not very far short of the truth; since, save the friction of the wheel, C, all the friction of the apparatus is external to the measurement. Now, the force which acts on the wheel, C, being transmitted in a direction opposite the gravity, the friction due to the weight of this wheel need not be taken into account. There only remains the friction of the teeth; but it is well known that wheels with inner teeth, especially when they are governed by a relatively large pinion, occasion very little friction.

If the causes of error of this new dynamometer be compared with those that exist in the White apparatus employed in the United States, it will be found that they are about four to five less.

By substituting a spring for the weight, P, any kind of a totalizer may be applied to the new apparatus.

The Return of the Rodgers Crew.

The Revenue steamer Corwin, which was sent to the relief of the officers and crew of the Rodgers (burned last winter in St. Lawrence Bay, Siberia), found on her arrival at the bay that the party had already been picked up by the steam whaler North Star. There were five officers and twenty-six men, all in fairly good health. They were transferred to the Corwin, which returned to San Francisco, arriving June 23. The commander of the Rodgers, Lieutenant R. M. Berry, with Ensign Hunt, were not with the party, having left St. Lawrence Bay, December 23, on a sledging search along the Siberian coast for the survivors of the Jeannette. At last report, April 4, Lieutenant Berry had arrived at Kolyma River, about half way between St. Lawrence and the Lena River.

On the 4th of February Master C. F. Putnam, commanding the supply depot at Cape Serdze Kamen, arrived at the native village where the Rodgers people had found refuge, with four sledges loaded with pemmican and other provisions for the party, he having heard of the loss of the ship through natives. He started on his return trip to the depot in bad weather, and was overtaken by a terrible gale of wind, with drifting snow, when two days out, and was obliged to turn back, and in his endeavor to reach the village on the southern side of St. Lawrence Bay, about twelve miles from North Head, he became separated from his native escort, and, not being able to see ten feet ahead of him, was carried out to sea on an ice floe. Later in the day he was seen about seven miles off shore, abreast of the village. A vigorous attempt was made to rescue him by four of the Rodgers crew and two natives in a canoe, but owing to the intervening ice they were unable to reach him. He was not seen afterwards. Search was made along the coast; four of his dogs were found, but no vestige of the unfortunate officer.

In a report to the Secretary of the Navy, sent forward by W. H. Gilder, Lieutenant Berry describes the burning of the ship, November 30. He was unable to determine the origin of the fire, but thought it most probable that it was caused by the heat from the donkey boiler, charring and firing the deck underneath. The records of the expedition were saved.

THE coast of Louisiana abounds in oyster banks, and a considerable oyster trade has been developed at New Orleans, giving employment to about 200 luggers, each manned by from three to six men.

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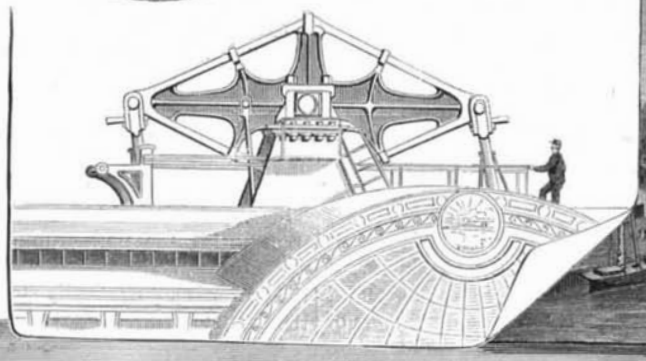
JOHN ROACH, OF NEW YORK.

HIS SHIP-BUILDING AND HIS VIEWS.

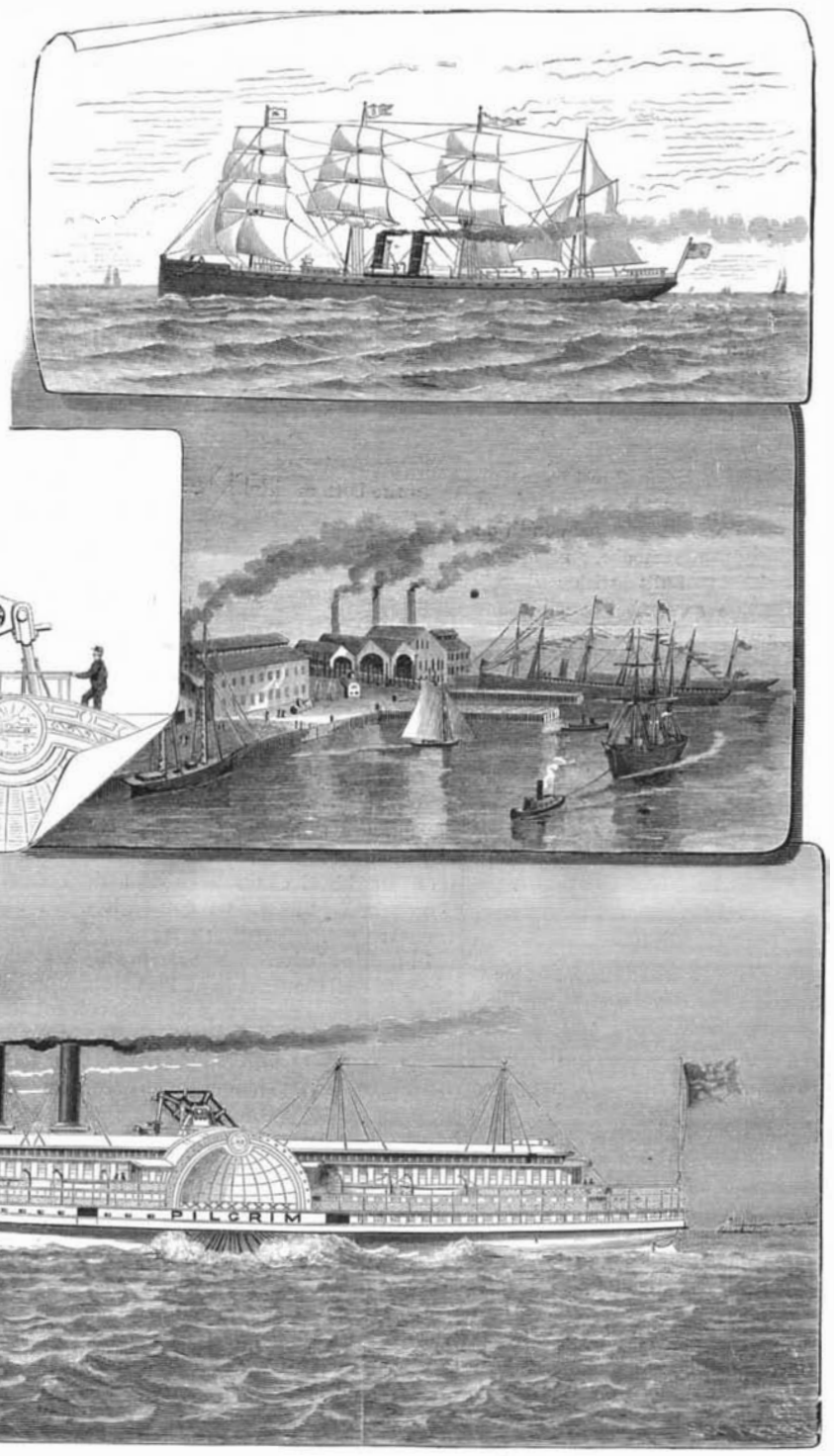
The Pilgrim, now in process of construction by Mr. John Roach for the Fall River Line, is the largest steamboat ever built. The company required the most commodious steamer, with the highest power and speed attainable, and this will in a few months be completed and delivered by the builder. Our engravings illustrate the forging of the shaft, one with the end in the furnace, for the "finishing heat," and the other "under the hammer."

This shaft is the largest ever constructed. And it must be borne in mind that the illustration represents only the half shaft. The other half is to be connected with it amidship by the crank, and is, of course, of the same length. Each measures 39 feet 6 inches in length, and is 28¼ inches at its largest, and 26 inches at its smallest diameter, and weigh each 81,200 pounds. This enormous shaft implies the size of the engine, and also the size and power of the boat, though in respect to the stability and speed of the latter, other conditions are to be considered of which we will make mention hereafter In considering this statement, many will think of large side-wheel steamers, including the Great Eastern, but they must also remember that each of her wheels is driven by a separate engine, which calls for a smaller shaft as it does for a smaller engine, while in this case, one engine drives both wheels, and is intended to do so at the highest speed and attainable power. Hence the necessity of a large piece of machinery. It is said, without fear of contradiction, that no other shop in this country could turn out such an engine, or forge a shaft of such magnitude. The capacity of a forge for such work depends upon the power of the steam hammer, and this one, though perhaps not the largest, has proved equal to turning out the largest piece of work yet produced. The hammer itself weighs not less than seventeen thousand pounds, and in its fall, driven down by steam power, represents a blow of not less than sixty-six thousand pounds. But certain it is that, in this case, a mass of iron at a forging heat, three feet in thickness, was pounded into shape. The anvil and block rest on a massive foundation, and this on a foundation of piles, in all some twenty to thirty feet deep, and the force of the blow is felt in the ground at a distance of several blocks. The method of working the steam hammer is illustrated in the engraving.

JOHN ROACH.



Walkingbeam of the Pilgrim.



THE PILGRIM. THE PEKING. Shipyard at Chester, Pa

SHIP-BUILDING WORKS OF JOHN ROACH & SONS.

The process of forging was not different from that in somewhat smaller work, but, of course, called for the exercise of special skill, in consequence of the peculiar difficulty of the task. To begin at near the beginning, "blooms" are prepared from "scrap iron." This "scrap iron" consists of an endless variety of wrought iron scraps, such as horse shoes, bolts, rods, nails, boiler iron, etc., etc. These are in the blacksmith shop welded together under a small steam hammer into bars, somewhat of the shape of bars of pig iron. The iron thus prepared is better for this purpose than any other, being tough and fibrous, and the product is known as a "bloom." In building the shaft begins with the "porter bar," on the end of which are piled the "blooms" for that heat. This "porter bar" is designed only for the purpose of carrying the first "blooms" into the furnace for a welding heat, and carrying them out again under the hammer. But inasmuch as it becomes incorporated in the shaft in part, it is carefully weighed, as are the "blooms," to ascertain how much material is used in the work. Afterward the shaft grows to a length sufficient to carry the blooms for its increasing length.

The process of hammering naturally increases the length of the mass of iron while it is being reduced to its proper thickness, and this increased length is hammered into two flat surfaces above, and below, known as a "scarf." On this "scarf," for the next heating, are piled from fifteen to twenty blooms, which are carried into the furnace, brought to a welding heat, and then put under the hammer, and welded into one mass. The shaft is turned over and a new supply of blooms piled upon the opposite side of the "scarf." These are then carried into the furnace, brought to a welding heat, put under the hammer, and welded. After another heating this whole mass is rounded into the desired size and shape. And so the process goes on of piling on the blooms, heating, forging, shaping, building up the scarf, and piling on more blooms. And the shaft goes on increasing in length. To do this work on each half shaft required about fourteen days' constant work. And to handle the shaft in heating and shaping required a gang of upwards of twenty men. This is, of course, apart from the work of preparing blooms, tending the furnaces, running the crane engines, handling material, the extent and cost of which are perhaps only known to the members of the firm and the book-keeper of the works. After each half shaft is completed in the forge, it is taken into the shop and then turned. This turning is done as perfectly and as neatly as if the iron, 39 feet 6 inches long, and not far from one yard in thickness, were intended for a gold watch. The machinery, appliances, and skill for such work are too well known to require description.

What is implied by the size of the shaft is carried out in all parts of the engine. The cylinder is 9 feet 2 inches in interior diameter, with 14 feet stroke, and was cast in the same works. The working beam from center to center is 29 feet long, by 14 feet 6 inches across, and weighs 38 tons. The paddle wheels are 41 feet in diameter.

These figures alone will convey a just appreciation of the magnitude of the work. The entire engine in all its material, casting, forging, turning, and putting together, was done in this shop. Needless to say the building is not large enough for the setting up the entire engine, and consequently the separate parts can alone be fitted, and after proper adjustment and numbering, removed. The niceness of the work done may be further illustrated by recalling the circumstance that we have witnessed the putting together a shaft and crank piece, an operation requiring so great promptitude and accuracy, that the slightest or smallest error will, in a few minutes, destroy thousands of dollars' worth of material. The crank is bored something like an eighth of an inch less in diameter than the diameter of the shaft. To admit of inserting the shaft the crank has to be heated sufficiently to expand the metal until the bore is of the same size with the shaft. Then the shaft, which has been kept at a uniform temperature, is inserted. If this is done too slowly, or the shaft does not go home to its proper place, or, from irregular turning, is not true in its bearing to the crank, the whole work is destroyed, and the iron has to be again broken up, for the hot crank piece has already closed upon the cold shaft with a grip making it impossible ever to separate them, and the two pieces are now one piece of iron. Considering that these pieces are of many tons in weight, the difficulty of the job and the requisite skill of the men become apparent.

Mr. Roach employs in this yard, where he builds most of his machinery, foot of East Ninth street, New York, from eight hundred to nine hundred men. The industries fostered, indirectly, by his enterprise are perhaps tenfold greater in number of men employed.

He builds his great iron ships at Chester, Pennsylvania, and there, alongside the unfinished ironclad Puritan, lies the Pilgrim on the ways. Here, as in the machine shop in New York, the entire work of building the ship is done, from its inception in the mind of the constructor to its launching and fitting up. Here is the furnace for smelting the iron; there the rolling mill for rolling plates and armor plating; and there the forge and shops and furnace for making the frame and iron timbers, so to speak, of an iron ship. On another page is a sketch of the water front of this yard, which is much larger than that in New York.

The general subject of ship-building is familiar to most of our readers, but we will insert here a brief reference to what is done in the yard at Chester. The constructor designs his miniature ship in wood, and therein exercises his peculiar talent and creative faculty, somewhat as the sculptor creates in his art. From this a sectional drawing of the same size is made, and from that again a larger scale drawing, and from that a table is constructed showing the measurements of all parts of the hull in feet and to the fraction of an inch.

The "displacement" of the ship, loaded and unloaded, is calculated, and so accurately is this ascertained that the constructor has been known to draw a chalk line

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on the hull of his ship before launching which showed her exact water line when launched. The water line of the ship in every possible position is known, and consequently her stability. From the table of proportions the shape of the cross sections or frame at any given point is laid out on the "mould loft" floor with great accuracy, in the actual size of the ship to be built. And from this wooden patterns are made to correspond with every part of the frame. These patterns are now in turn placed upon an iron floor, covered all over with square holes intended to receive iron pins, and its curvature accurately marked in and out among the holes, which are then supplied with pins and bolts. The angle iron intended for that particular rib or part of the frame is brought from the furnace at a red heat, and after being drawn into this curved line, is bolted down until it cools into permanent shape. Two are made alike, corresponding for the opposite sides of the ship; so of every part of the frame from stem to stern. The iron plates are rolled in the mill, with equal care, into the required curvature for each part of the ship, sharp or gradual as to the position required. Each plate has its number and place to which it is brought ready shapen to be laid in place, where and when alone it can be placed, and then riveted to the frame.

The drawing room of this yard presents to the visitor perhaps a more perfect idea of the extent of the works than any other part. It has the appearance almost of an art gallery of marine subjects. Every object the eye rests upon is a reminder of ships. The walls are covered with pictures and models of every form of ocean steamer, steamboat, and yacht built or now building, these models beautifully executed, while the cases are filled with working drawings of every part of the ship, finished in the most elaborate manner. The party for whom the ship is to be built indicates generally what is to be her carrying capacity, and possibly expresses some fancy as to her lines, but beyond this the constructor designs the ship, whether as to practical considerations or matters of fancy.

On another page we give a sketch of the City of Peking, the largest ship yet built by Mr. Roach, turned out of this yard, and of a design in construction which has been largely followed, and has received very general commendation. There are in process of building here six or more iron ships, designed for foreign trade, the work as well done as can be produced in any shipyard in the world. The United States ironclad, Puritan, lies on the stocks in an unfinished condition. It seems incomprehensible that the Government should leave so magnificent a ship in an unfinished condition for so many years. Near by, on the stocks, and almost complete, is the Pilgrim. She is built with a double hull, that is, two iron hulls, one somewhat smaller and inside the other, braced together. This gives increased strength on the principle of the tubular bridge, and safety in case of injury to the outer hull. Her length over all is 390 feet, 87 feet beam outside the guards amidship, and 12 feet draught, with a proposed speed of twenty miles an hour. The American ensign, presumably in proportion, is to be 30 x 20 feet. She appears on the stocks like an iron mountain, and that, too, without saloons or deck houses. As the shaft implies the engine, so the work turned out implies the magnitude of the works, the capital, skill, and enterprise of its organizer, as well as the labor, skill, and materials utilized. The average number of laborers in this yard is 1,800 to 3,000.

During the past ten years the firm of John Roach & Sons has built and delivered over one hundred iron steamers. That is to say, ten per year on an average, that is, one in a little over a month each—building the ship and the machinery; these representing contracts with the South American States, Spain, and our own people.

Ship building in Chester was practically unknown until Mr. Roach established his yard there, some ten years since. And now, as we have said, he finds employment for 1,800 to 3,000 men, with all that is incidental to such employment for the benefit of a place.

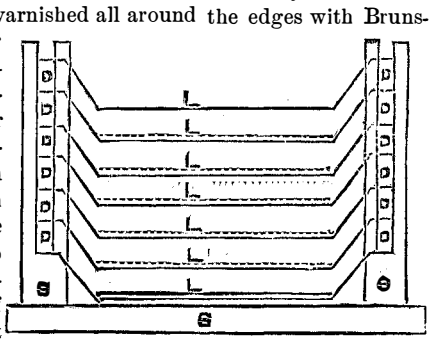
The story of the career of this man, who is the father of American iron ship-building, has that simplicity which attaches to the lives of most eminent men, an oft told tale, but in his case one of almost unparalleled success. He commenced business life as a boy in the foundry of the Allaire Iron Works, in New York, as a moulder, at a time when the best workmen received a precarious compensation of one dollar per day, and it may be easily conjectured what a poor boy must have received. He there learned his trade, passing through the daily experience of young men in that capacity.

Subsequently, when he had acquired sufficient knowledge and saved up sufficient capital, say, fifty dollars, he established a foundry of his own, "ridiculously small," as some one has said. But it grew, though at first no one would have believed it to be a foundry, until it became to be the celebrated "Etna Iron Works." Commencing with small castings, the contracts grew to large castings, then a machine shop, and boiler shop. During his early days it is not recorded that he was one of the strikers, but after he started his little foundry he continued to be one of the hard workers. It is pleasant to know that since then he has bought out some of the tools, machinery, and appliances of the Allaire works, in which he was employed as a boy. About the year 1868 he came into occupation of what is known as the "Morgan Iron Works," and about 1872 purchased most of his property at Chester. It has often been predicted by companies, in his line of business, that he must fail, because one man *could not* succeed where a corporation could not prosper and often has failed. But he has prospered, and the beginner with fifty dollars now has a property representing millions. The secret lies within the man. Extraordinary physical and mental energy, at work night and day from year to year, frugal in habits and democratic in feeling, practical, strictly reliable in all his engagements, he is a representative man of a thrifty and enterprising age. And with it all he is kindly and charitable. No one complains of his being rough and coarse, and many can testify to his considerateness. One who has known him for years remarked, and the figures prove it, "If Mr. Roach should die to-day it would be a *calamity* to New York and to Chester." Many things have been said about him in reference to "monopoly" and "protection," but it would seem that a man who has been able to build up as he has builded, and to represent an industry such as this is, is qualified to judge of the needs of the country in ship-building, and to give "protection" to the hundreds for whom he finds employment. The portrait of Mr. Roach that accompanies our sketches gives an idea of his personal appearance.

Mr. Roach is known to be a man of decided opinions in respect to the promotion of American industries, and our sketch would be quite incomplete did we not give our readers some notion of his ideas relating thereto; these, naturally, form the second branch of our subject, and are so extensive and interesting that we present them in a special article printed in this week's SCIENTIFIC AMERICAN SUPPLEMENT.

A SIMPLE FORM OF STORAGE OR SECONDARY BATTERY.

It consists of a series of shallow thin lead trays, L, about one-fortieth of an inch thick, pressed and hammered into shape in a wooden mould. These trays are arranged one over another in a wooden frame, S. The trays are kept at an equal distance from each other by pieces of wood, which slide up and down in the stand, the ends of the slides being shown at D. The dotted lines in the bottom of the tray represent layers of red lead, or oxide or reduced lead. On this is poured an acid solution of sulphate of copper, just deep enough to immerse the bottom of the tray above. The trays should be varnished all around the edges with Brunswick black, or some other acid-resisting varnish. Wires for poles are soldered to the bottom of the bottom tray, and to the top of the top tray. The battery may, of course, consist of a greater number of trays, and a series of batteries may be connected together.



The advantages of this form of battery are, the oxide of lead can always be kept at the most advantageous thickness. The plates or trays can also be arranged at the most advantageous distance from each other. No diaphragm of any kind is required, and therefore, however long in action, no reduced lead can weaken its action. The battery must always be kept level. Of course, it could not be used in tramcars, etc.

In making batteries on a large scale it would be well, perhaps, to cas the trays in an iron mould, and then it would be well to have one corner of each cell cut off; and let this be done on alternate sides, to facilitate the inspection and supply of liquid. It would be well then to mix antimony with the lead to harden it. Possibly the trays may be made of carbon.—W. *Symons, F.C.S., in English Mechanic.*

The Census of Canada.

The first volume of the Canadian Census Statistics of 1881 have just been submitted to the Dominion Parliament by the Hon. J. H. Pope, the Minister of Agriculture, and contains various interesting schedules, among which are those relating to the religions and nationalities of the population. With regard to the former the particulars are as follows: Roman Catholics, 1,791,982; Presbyterians, 676,155; Adventists, 7,211; Baptists, 225,236; Free Will Baptists, 50,055; Mennonites, 21,234; Brethren, 8,831; Church of England, 574,818; Congregationalists, 26,900; Disciples, 20,193; Episcopal (Reformed), 2,596; Jews, 2,393; Lutherans, 46,350; Methodists, of all classes, 742,981; Pagans, 4,478; Protestants, 6,519; Quakers, 6,533; Unitarians, 2,126; Universalist, 4,517; no religion, 2,634; other denominations, 14,269; not given, 86,769. Total, 4,324,810. The population of Canada includes the following nationalities: Africans, 21,394; Chinese, 4,383; Dutch, 30,412; English, 881,301; French, 1,298,929; German, 255,319; Icelanders, 1,009; Indians, 108,547; Irish, 957,403, Italians, 1,849; Jews, 667; Russians, 1,227; Scandinavians, 4,214; Scotch, 699,863; Spanish and Portuguese, 1,172; Swiss, 4,588; Welsh, 9,947; all others, 43,587. According to nativity, the population of the Dominion stands thus: Natives of England, 169,504; Ireland, 185,526; Scotland, 115,062; Ontario, 1,467,988; Quebec, 1,227,809; Prince Edward Island, 101,047; Nova Scotia, 420,088; New Brunswick, 288,265; British Columbia, 32,775; Manitoba, 19,590; Territories, 58,430; other British possessions, 10,368; France, 4,389; Germany, 25,328; Italy, 777; Russia, 6,376; Spain, 215; Sweden and Norway, 2,076; United States, 77,753; other countries, 14,169. The male population of Canada number 2,188,854, and the females, 2,135,956; married, 1,380,084; widowed, 160,330; unmarried, 2,784,396. Canada was divided for census purposes into 192 districts, and 2,139 sub-districts.

Train Brakes for Freight Cars.

The committee on train brakes for freight cars, appointed by the Master Car Builders' Association, reported at the late meeting that very satisfactory progress has been made in the last three years.

The Reed train brake has been considerably simplified in construction during the past year, and is doing good work on the Harlem Division, where it has been in operation for nearly two years.

The American Brake Company report having their train brake in successful operation on 500 cars on the St. Louis and San Francisco Railway, and that for cheapness, efficiency, and durability it is all they claim for it. Reports from the above railroad company give some 500 cars equipped with this brake running over a period of some fifteen months, and in that time several bad wrecks have been avoided by its use. The weight of the brake applied to one truck is 140 pounds per car, and the first cost $11.75, while the annual cost of repair is very small.

The Tallman train brake, which has been working successfully on the Harlem Division for nearly two years, is also running on ten cars of the New York Live Stock Express Company between Chicago and New York. At two trials of this brake in February, on the Central Railroad of New Jersey, excellent stops were made, some of them as follows:

Speed 20 miles per hour, down grade, stopped in 360 feet in 18 seconds; speed 25 miles per hour, down grade, stopped in 450 feet in 22 seconds; speed 35 miles per hour, down grade, 23 feet to the mile, stopped in 1,080 feet. A trial of this brake on the Chicago, Rock Island, and Pacific Railroad proved quite satisfactory. Exact data not given.

The Pennsylvania Railroad has some 75 stock cars equipped with the Westinghouse air brake, but are not yet satisfied in regard to its practicability for freight service.

There have been two new brakes brought out since the last annual meeting of the association, which the committee think worthy of mention. The Fuller and Salvadge brake is in successful operation on a construction train on the Grand Trunk, Georgian Bay, and Lake Erie Railway. This brake is independent on each car, being operated by compression of draw-bar. The cost is about $20 per car.

Also the Stowe brake, which is of peculiar construction, requiring neither air, steam, compression, nor electricity to operate it, for which the following is claimed: A short chain between the cars sets the brake automatically on all cars equipped with it, which are connected together. Where a train breaks in two, and should the brake be out of order on one or more cars, it does not affect the efficiency of the others, each car taking care of its own slack chain while transmitting the power unimpaired to its neighbor, and when the brake is applied, and the train brought to a stop, the power is automatically stored up on each car ready for the next stop.

A Novel Balloon.

A NEW steerable balloon, the invention of Herr Baumgarten and Dr. Wälfert, was recently tried at Charlottenburg. It is of huge size, having a capacity of about 473 cubic yards, and is ellipsoid in form, the longer diameter being about 58 feet. It differs in principle from all other aerostats in that, although inflated with hydrogen, it has no ascensional force; its total weight is about 2 1-5 lb. above that of the air it displaces. The means of displacement in the horizontal or the vertical direction are a helical system of vanes actuated by machinery in the car. Hence, in making land, the balloon does not require to be partly emptied, and on reaching the ground it has nearly the same quantity of gas as when it rose.

Another novelty consists in the mode of connection of the car. This is rigid. Thus the dangerous bounds or jerks to which the ordinary balloon-car is liable in landing are to some extent avoided. The car being usually suspended by ropes, the system is suddenly relieved of its weight when it touches the ground, so that the balloon shoots up again, giving a series of violent shocks. With a rigid connection the total weight cannot be thus temporarily diminished. The mechanism has a double action, one helix of vanes, or screw propeller, driven in one direction or the opposite, produces ascent or descent, while a couple of screws give horizontal propulsion; in a pretty calm atmosphere the horizontal direction may be modified by working one of the couple alone. The first experiments, it appears, were quite successful. The weather was exceptionally calm. In a second trial a slight accident ruptured the envelope of the balloon, and the car mechanism was also injured. The experiments are soon to be resumed. The motor, it may be mentioned, has a force of 4 horse power and weighs 80 lb. The cost of charging each time the balloon is filled anew is about $100.

Fast Speed from China to London.

The new steamship Stirling Castle, from Hankow, China, lately reached London, after a run of 29 days 22 hours, the fastest on record. The distance from Hankow to London is 11,250 miles, so that the Stirling Castle made an average of more than 375 miles a day, making no allowance for detention at coaling ports and time occupied in passing through the Suez Canal.

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Origin and Evolution of French Heels.

It has generally been assumed the high heels seen on the boots worn by Parisian ladies are the invention of some enemy of the human race who delights in inflicting torture upon the fair sex in the name of fashion. It would seem, however, from recent researches that what is now worn merely as an object of beauty was originally adopted for practical purpose and were then articles of use instead of beauty. A medical writer of the olden times, before French ladies had invented, or more properly adopted, the heel, says: "In Paris, where the streets have no side pavements, the ladies are obliged to walk almost constantly on tiptoe." Although the author used this statement to illustrate a different subject, it goes to prove that the habit of walking on tiptoe was forced upon the ladies by wet streets (Paris streets are still kept wet in winter and summer alike) and thin soled shoes. It is easy to see that this gave them a peculiar gait that was at once light and airy, as well as graceful. It requires some exertion to maintain this tiptoe walk for long distances, although this exertion is rewarded, as this same writer tells us, by an enlargement of the calf of the leg to such an extent that it has given them a conformation of the leg and foot to match which the Parisian belles proudly challenge the world. "Nevertheless some lazy belle (?) probably thought to accomplish the feat of walking on tiptoe with less exertion by a support placed under the heel of the foot, and this gave rise to the French heel. That it must be placed farther under the foot than a flat heel will be evident on a momentary consideration. A plumb line let fall from the heel of the foot (the *os calcis*) when standing on tiptoe will fall nearer the toe in proportion as the heel is raised, until, in the extreme case of dancers who actually stand on their toes, the two coincide. The mathematician expresses this by saying that the base of a right angled triangle is less than its hypothenuse. The length of the foot, which is the hypothenuse, remaining constant, the distance from the toe to the heel of the boot, where it touches the ground, must, by the inflexible laws of mechanics and mathematics, decrease as the height of the heel increases. It is true that this makes the foot look shorter and thus favors the vanity of the wearer, but this is an incidental and unavoidable consequence, not a cause.

The French heel has been blamed for much that it does not deserve because its object is not understood and hence it is improperly used. The wearer of a Fench heel should bear in mind the fact that such heels are only intended as a slight assistance in walking on tiptoe and to make the carriage more steady and uniform than walking on tiptoe ordinarily is, instead of supposing that they are to bear the weight of the body as flat heels are.

The square "heel and toe" walk of the pedestrian should never be attempted on French heels. The force with which the wearers strike their heels is shown by the fact that they are generally iron clad or shod with brass, and that on old boots they are invariably worn off or "run over." This should never be. A lady that would walk gracefully and properly on French heels should be able to walk as well on glass heels as on iron or wooden ones. Worn in this way real French heels (not the base imitations sold as such in this country) would develop the calf and improve the shape of the leg instead of injuring it as high heels now have the reputation of doing, and the serious charge that surgeons make of their throwing the whole weight of the body on the arch of the foot would vanish at once.

Ladies (and gentlemen too) if they wish to walk gracefully on French heels may practice indoors by taking a pair of slippers or lace boots *without heels*, and fastening to each, at the point where the heel should be, a small rubber ball with a whistle in it that makes a noise when it is squeezed. The size of the ball will correspond to the height of heel to be worn. When the wearer gets so she, or he, can walk without pressing on the balls hard enough to make them squeal, they will be able to walk *lightly* and gracefully on French heels without any danger to the arch of the foot, and without any need of brass heel plates.

It is evident that pointed toed boots are not so well adapted to use with French heels as square toed ones, for in all tiptoe walking the toes *must* have plenty of room. Short steps are also preferable to long strides.

It is not the part of science to discuss the relative *beauty* of high and low heels, but merely to state the underlying principles of mathematics and anatomy, and to show how they may be made conducive to health instead of as now the reverse. Hitherto scientific observers have held themselves aloof from all matters of fashion, treating her with contempt. Hygienic reformers content themselves with abusing fashion, which goes on totally indifferent to all they say. No one has ever attempted to study the science of fashion, and yet Herbert Spencer says that wherever there are facts which can be collated and compared, we have the basis for forming a science.

If there is a science of history there must be a science of fashion, absurd as this may sound. Facts are abundant, and we have every reason to believe that the principles of evolution and development will be found to hold good there as elsewhere. The above sketch of the origin of French heels will serve to show that, when properly interpreted, some of the most absurd fashions teach a useful lesson, and if properly directed they may lead to benefit instead of injury. It is safe to assume that 25 per cent of our people are bound by the chains of fashion. Is not a subject so intimately associated with the welfare of humanity worthy the study of scientific men?

A Perpetual Motion Clock.

Mr. Dardenne's self-winding perpetual clock may now be considered to have had a fair trial. A specimen clock was fixed at the Gare du Nord Terminus, Brussels, last September, all due precautions being taken to avoid tampering with it by affixing the government seal. After six months' trial it was found in perfect time with the Observatory clock, and had not varied in the slightest degree during that time. The clock is wound by a small anemometer or windmill, which is placed in a ventilation pipe, chimney, or any other place where a tolerably constant current of air can be relied on. This windmill is, by a reversed train of multiplying wheels, continually drawing over a wheel an endless chain, in one loop of which the clock weight is supported. As the loop hangs between the clock and the winding machine the weight is continually drawing through the clock the slack chain drawn up by the wind motor, and thus a constant motion is maintained. A ratchet wheel prevents the motor from turning the wrong way, and, by a simple arrangement, whenever the weight is wound right up to the top, the motion is checked by a friction brake automatically applied to the anemometer by the raised weight lifting a lever. When the weight is thus raised to the top, the clock has a sufficient store of energy to go for twenty-four hours, so that it is not by any means dependent on a regular current of air. As this clock receives such a liberal supply of winding, it does not require so long a train of wheels as an ordinary clock. The works of the clock are only connected with the winding arrangement by means of the loop of chain, so that no injurious matters can reach the former from the chimney.

Rice vs. Maize in Brewing.

According to published analyses, perfectly dry maize contains 67½ per cent of starch and 4 per cent of intermediate carbohydrates, or a total of 71½ per cent of sugar producing constituents; but dry rice contains 89 per cent of starch and 1 per cent of intermediate bodies, making a total of 90 per cent. For the purpose of our present argument we may ignore the other constituents of the two materials, for they have either to be removed prior to mashing or they are insoluble, or have to be rendered insoluble during the mashing process; incidentally we may mention that the existence of large percentages of fatty and albuminoid substances in maize constitute an objection to this material for brewing purposes, for these constituents having to be removed there is a danger of some portion remaining, and thus deteriorating the wort. Now, taking the present market price of maize at 6s. 6d. per cental, and rice at 7s. 6d. per cwt., excluding the moisture, maize now costs 7s. 4d. per 100 pounds, and rice 8s. 5d. per cwt., or 7s. 6d. per 100 pounds; we then find by simple calculation that every pound of available saccharine extract from maize costs 1·23 of a penny, or about 1¼d., while a pound of available extract from rice costs one penny, that is, about 20 per cent less. The cost of working the two materials is as nearly as possible the same, for the expense separating the fatty and albuminous constituents of maize is just about covered by the value of these constituents for other purposes. Our calculations are, of course, based upon the present relative prices of the two materials, and the tendency of the market is toward a still further increase in the price of maize. As to the quality of the extract, we consider there is nothing to choose between rice and maize, provided the latter is submitted to the necessary preliminary treatment for the separation of the objectionable constituents.—*Brewer's Guardian.*

Spiders' Threads.

The Rev. H. C. McCook has been studying the mode of constructing webs prevailing among the orb-weaving spiders, and he seems to have confirmed his previous opinions that the silk line framework or foundation of their webs is laid in the first instance by the help of a current of air carrying the thread. In a great number of cases Mr. McCook observed the spiders passing from point to point by means of lines emitted from their spinnerets and entangled upon adjacent foliage. These mimic "wire bridges" were of various lengths, owing to the direction of the wind and the relative positions of the spider and the fixed objects around it. Lines of 2 feet to 4 feet were frequent; lines of from 7 feet to 10 feet occurred pretty often; one line had been measured for a length of 26 feet, and in several instances they had been observed stretching across country roads of from 30 feet to 40 feet width. He had also observed some of these carried by the wind directly from the spider's spinnerets; had watched the entanglement; had seen the spider then draw the threads taut, and finally cross upon them. These air-laid bridge lines were often used for the frames of the orb, though undoubtedly the foundations for these were also very frequently made as described by the Rev. O. Pickard (Cambridge), by the spider fixing its line to one spot, then traversing the distance to some other spot, and then hauling in the slack. The observations of Mr. McCook show nothing like a deliberate purpose in connecting the point of occupancy with any special opposite point. The spiders seem to act in the matter very much at haphazard, but with a special instinct of the fact that such behavior would secure available attachments. Many of the bridge lines were evidently tentative, and were chiefly at the mercy of the breeze, although some observations seemed to indicate a limited control of the thread by manipulation. As a generalization from many observations Mr. McCook concludes that webs built in large open spaces are perhaps always laid out by bridge lines, while in more contracted spaces the frame lines are generally carried around, and often a foundation is the result of both methods.

A New Jersey Mastodon.

The discovery of a mastodon skeleton near Freehold, N. J., adds to the evidence that some of those huge creatures must have survived until a period geologically quite recent. The bones were found by a farmer while digging a trench for draining a swampy meadow, and examined by Dr. Samuel Lockwood. The tusks were nearly eight feet long, but too much decayed to be preserved. The bones of the head, which were lying within two feet of the surface, were so soft as to be easily cut with a spade. They were nearly the color of the black vegetable mould of the meadow, and therefore almost indistinguishable But a careful inspection showed that the front part of the head was greatly similar to that of the elephant of the present day, except that the forehead was abnormally high. By a close investigation of the skull, numerous air cells, some of them an inch in diameter, were found. The bone of the skull was of an immense thickness, but completely honeycombed with these air cells. These cells had become filled with the fibrous roots of plants which extended through the entire skull. After digging through the skull and coming to the lower part of the head, three or four more teeth, similar in shape, size, and weight to that already described, were found. The teeth, unlike the tusks and bones, were in a remarkably good state of preservation. The exploration was continued until the entire body was laid bare. Beneath the bones was found a bed of sand, upon which the animal had evidently lain down to die. The bones of the body, though greatly decomposed, were plainly distinguishable, and the position of the animal was ascertained. It was lying with its head to the north-east, and its legs stretched out at length at right angles to its body, and its head inclined toward its chest.

The region about Freehold is believed by geologists to have been recently raised above the surface of the ocean.

Fresh Meat from New Zealand.

The sailing vessel Dunedin, belonging to the Albion Shipping Company, lately arrived in the East India Docks, London, with the first consignment of frozen meat which has been sent to England from New Zealand. This shipment differs from all other importations of frozen meat, from the fact of having been made in a sailing vessel, which has been 98 days on the passage, during which time the holds of the ship containing the meat have been kept at about 20° below freezing point. The vessel has on board 5,000 sheep, and the apparatus for freezing was fitted up by the Bell-Coleman Mechanical Refrigerating Company.

The meat was in fine condition, and the shipment has been managed by the New Zealand and Australian Land Company (limited).

The success of this refrigerating sailing vessel ought to lead to a great extension of the trade in tropical fruits between New York and the West Indies. By the use of a refrigerating machine the immense losses now experienced by our fruit ships may be wholly overcome, and the finest fruits may be delivered here in prime condition. Vegetables may also be brought from the south without loss. For engravings of the above refrigerating machinery see SCIENTIFIC AMERICAN SUPPLEMENT, No. 314.

Chinese Stock Farming.

An interesting account of the establishment of a stock farm by the viceroy of the province of Chihle, in China, has been given by the American Consul-General at Shanghai. In one of his previous reports he had pointed out that the Mongolian herds could be greatly increased in value by the establishment of a farm at some convenient locality, at which fine stock, horses, cattle, and sheep could be bred. This report came under the cognizance of his Excellency Li, with the result that an interview between the Consul-General, a breeder from New York, and Li was brought about. The New York breeder urged the advantages of a good stock farm very strongly, and his Excellency took up the matter warmly. Through his active interest and influence, Mr. Tang King Sing, an active and progressive mandarin, was convinced of the superiority of Western ideas, and at once declared his willingness to give them a trial. His farm consists of about 5,000 acres, near the Kaiping coal mines, now being opened by foreign engineers under his superintendence, situated about 80 miles to the north of Tientsin. He has obtained some United States cattle, which will be used with the native stock for the purpose of testing the practicability of the suggestions which have been made. Mr. Tang King Sing announces that in the promotion of this enterprise his object is to afford his countrymen an opportunity to become possessed of at least a portion of the science already attained by Western nations in the improvement of their breeds of cattle. The result of this movement will be watched with no little interest.

A Moving Bog.

An Ennis telegram reports that some hundreds of acres of bog on the estate of Mr. Ralph Wistropp, in East Clare, Ireland, on the afternoon of May 26, commenced moving to the southeastward, carrying before it several patches of reclaimed land under cultivation for potatoes. Part of the main road to Limerick was also destroyed. Emergency men have been telegraphed for to repair the damage. According to the latest accounts the bog was still moving.

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AUTOMATIC BOILER FEEDER.

The apparatus we here illustrate takes its name from its inventor, M. Edouard Fromentin, of Paris. It may be designated a water bottle feeder, and is made automatic by coupling two "bottles," as they are technically named, on to one and the same axis, and on which they turn. The bottles are alternately placed in communication with the boiler, through the pipes connected up to the former at both the top and bottom of the latter, and thus a slight additional pressure only is required to allow the water to pass freely into the boiler; this is obtained by placing the apparatus slightly above the water level, and thus utilizing the force due to gravity for that purpose.

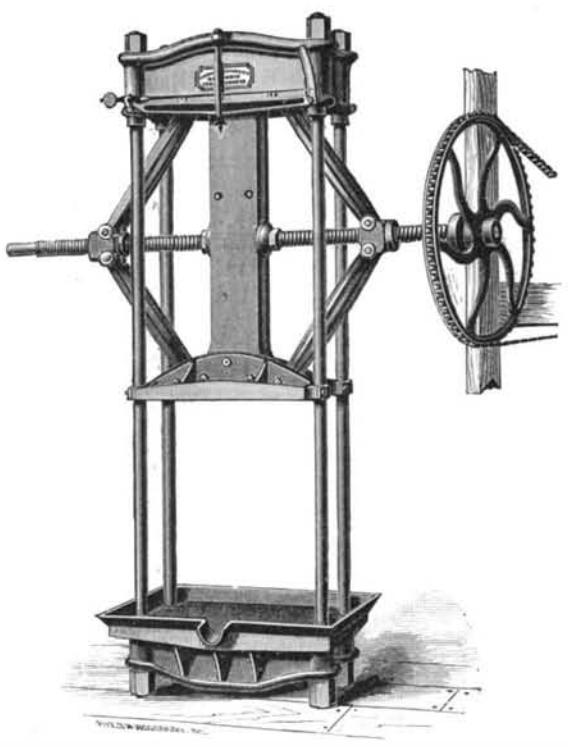
Referring to the annexed illustrations it will be seen that the Fromentin self-acting feeder consists mainly of the two pear-shaped bottles, circular in cross section, and each capable of holding about 12 gallons of water, these two bottles being connected to the central disk by means of two sets of pipes. The pipes marked 2, 2^1, connected to the top of the bottles, are those through which steam finds its way alternately into the two bottles each time the apparatus moves or makes a stroke, this taking place whenever the water level in the boiler is lower than it should be, or than the bottom end of the plunge, or steam supply pipe inside the boiler. This steam supply pipe finds an inlet to the apparatus at the top flange 11, Fig. 2; the outlet for the non-condensed steam is at 14, this steam by means of a pipe being led back into the water supply tank and thus assisting in heating the cold supply water before it goes into the bottles. The water supply inlet to the apparatus is at 13, and the outlet or delivery to boiler at 12, the water passing into the boiler through an ordinary check or back pressure valve mounted close up to the boiler in the usual manner; the arrows shown at each of these passages in Fig. 2 indicate the direction taken by both steam and water.

The two disks on which the apparatus turns are represented in Figs. 3 and 4, that shown by Fig. 3 being stationary and bolted down to the foundation plate, while that represented by Fig. 4 is movable, the latter being that disk to which the two bottles are connected by means of the pipes before mentioned. In the fixed disk Fig. 3, and which receives at the back all the flanges and connections, including both the water and steam supply as well as the delivery to the boiler, there are, as is seen, two distinct sets of ports, the top set being for steam and those at the bottom for water; the movement given to the apparatus is just sufficient to open and close these ports.

The two cylinders, 18, 18, Fig. 1, contain water, and the descent of the pistons in them is met with just sufficient resistance to allow the loaded bottles to come down noiselessly and without knock; the stroke is about 10 in., and is adjusted by means of the pistons in these cataract cylinders. The apparatus moves or makes one stroke on the average about every three or four minutes, but its action being purely automatic and its function to maintain a constant level, the number of strokes in a given time must necessarily depend upon the rate of evaporation.

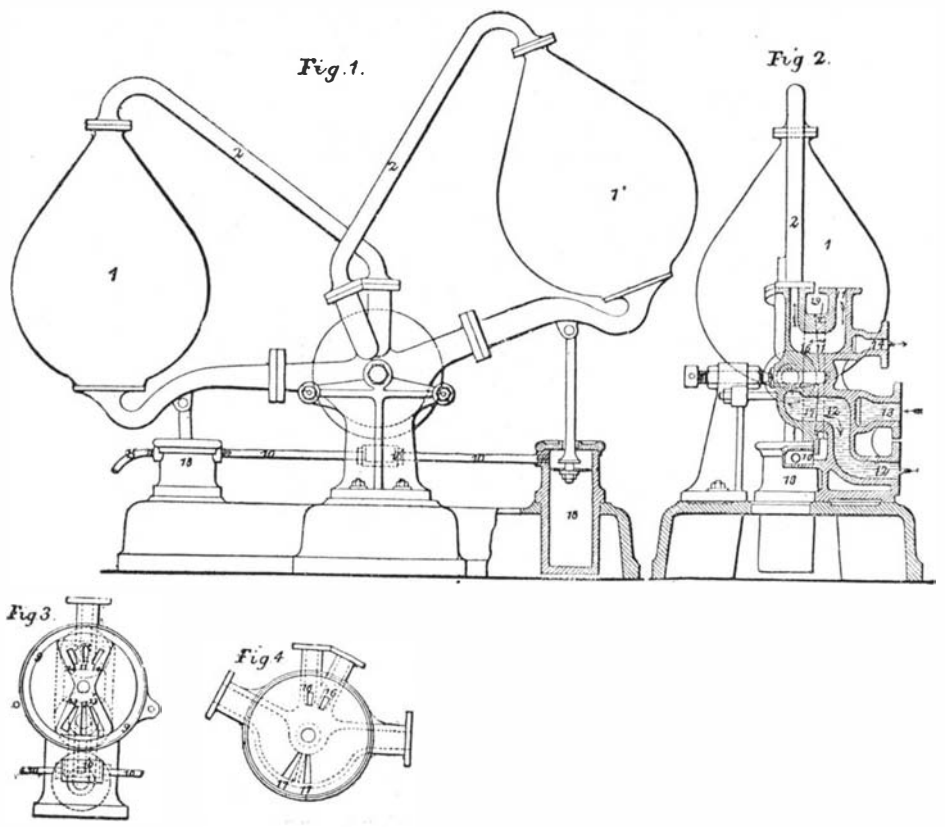
The general action of the apparatus may be summed up thus: for instance, in the above illustration we will suppose the feeder has just moved or made a stroke in consequence of the now lower bottle 1, Fig. 1, having while uppermost been filled (and thus become the heavier of the two) with water from a small supply tank or from the town water service pipes, while at the same time the opposite bottle 1^1, Fig. 1, while lowest, has been emptying a portion of its contents into the boiler; this state of things has, however, been now reversed, and, as seen in Fig. 1, the bottle 1 is open to the boiler, and the water level in the latter being slightly lowered by evaporation, steam passes at once into the now full bottle up the pipe 2, and presses on the surface of the water with a force due to the boiler pressure, the water gradually passing out of the bottle by way of the pipe attached to the bottom of the same into the boiler through the delivery pipe and check valve, the flow of the water from the apparatus boilerwards being simply due to gravity or to the elevation of the apparatus above the level of the water line in the boiler—an elevation which need not in any case exceed three feet.

It may also be remarked that when the water level in the boiler is at its maximum, or say when the lower end of the plunge steam pipe is sealed, steam is then of course no longer able to pass up the pipe into the bottles, this state of affairs continuing until by evaporation the water level has again become lowered sufficiently to unseal this pipe. It is while the water is at the maximum level that certain returns of water from the boiler take place back into that bottle then in communication with the boiler through either one or other of the two steam pipes, 2, 2^1, attached to the bottles, the steam which had previously found its way into the bottle having condensed and left the latter partially empty, but the vacuous space being soon filled up again by these rapid returns of water from the boiler. This reversal of current through the pipes and the intermixture inside the bottle of the water of a higher temperature direct from the boiler with that already remaining in the bottle is found by experience to be productive of the most beneficial results, as it not only keeps all the ports, pipes, bottles, etc., clean and free from all scale or deposit of any kind, but also lends material aid by way of preventing incrustation in the boiler,



PRESS FOR THE MANUFACTURE OF OILS.

the solids contained in the water being precipitated in the bottles under the action of a higher temperature before admission to the boiler, and thus scaling or incrustation inside the boilers fitted with this apparatus being, it is claimed, greatly diminished.—*Engineering.*



THE FROMENTIN AUTOMATIC BOILER FEEDER.

How Agates are Formed.

A step toward the solution of the enigma as to the formation of agates, the *Academy* says, has apparently been made by Messrs. J. I. Anson and E. A. Parkhurst. By introducing through a pipette some strong acid into a solution of an alkaline silicate, which contains also a certain amount of alkaline carbonate, a stream of bubbles of carbonic acid is disengaged, and around the ascending stream of gas a tube of gelatinous silica is soon formed. The continued addition of the acid causes a growth of silica, which forms a series of concentric tubes suggestive of the stalactitic forms often seen in agates. If a cavity containing a solution of an alkaline silicate exist in a rock which is permeated by an acid solution silica will be deposited in successive zones around the internal walls of the cavity, and thus the origin of banded agates, of the endogenous type of growth, may be explained. Some of the artificial specimens illustrate also the stalactitic or endogenous type of growth.

To remove rust from saws, chisels, etc., first scour with emery moistened with sulphuric acid diluted with six volumes of water, rinse, dry, and finish with oil and emery flour.

PRESS FOR THE MANUFACTURE OF OILS.

The press shown in the engraving is designed for use in the manufacture of oils where the material to be pressed is inclosed in canvas and pressed between wrought iron plates. It is very extensively used in the manufacture of oleomargarine, being among the first, if not the very first, used in this country for that purpose. They are also largely used for the second or "hard" pressing of paraffine wax, the first, or "slack" pressing being made in presses of same principle, but having wood frames and of larger capacity. The presses are worked by a chain-belt passing over a chain wheel on the end of the horizontal screw, and from thence to a "power attachment," to which motion is communicated by belting from the line shaft. Upon the head is fastened a system of levers called an "indicator," and which, by the spring of the casting shows the amount of pressure being transmitted to the material being pressed. The power of the press shown is 250 tons. These presses have a very solid and substantial look, and the reputation of the company warrants the belief that the material and workmanship are of the best. This company build presses for various uses where the hydraulic was once the only press used, and from the peculiar progressive movement of the platen and increase of power as the material under pressure becomes dense, together with the fact that it never yields to the pressure, it is in very many cases being substituted for it. At their New York office experiments are made free of charge with such materials as require heavy pressure.

Further information may be obtained by addressing the Boomer & Boschert Press Co., Syracuse, N. Y., or 62 Vesey street, New York city.

How to Make the Phosphorus Metals.

For the preparation of phosphorus compounds of metals, for example, phosphor-copper, Dr. H. Swarz gives in the *Industrie-blätter* the following directions:

A mixture of bone ash, silica, and carbon is placed in a crucible and upon it a layer of granulated copper, which is in turn covered with the above mixture. The lid of the crucible is luted on. To make it melt more easily, some (carbonate of) soda and glass may be added, or a mixture of pulverized milk glass with charcoal and powdered coke is used for lining and covering it. Take, for example, fourteen parts of silica, eighteen parts of bone ash, and four parts of powdered carbon. This is mixed with four parts of soda and four of powdered glass, stirred up with a little gum water, and used to line the crucible. When this is dry the copper is put in and covered with the same mass and the whole melted at a bright red heat. The copper obtained flows well, and has a reddish-gray color. It contains from 0·50 to 0·51 per cent. of phosphorus.

The simplest method for introducing phosphorus into bronze, says the *Metal-worker*, is to stick a bar of the phosphorus into a tube of pinchbeck, one end of which is hammered together and closed tightly. After the phosphorus is put in, the other end is closed too. When the metal, which contains thirty-two parts of copper to five of zinc and one of tin, is melted, the tube charged with phosphorus is pushed down in it to the bottom of the crucible by means of a bent tongs.

The stick of phosphorus must always be kept under water until it is about to go into the pinchbeck tube, when it must be carefully dried, as the presence of any moisture would be sure to cause the metal to spurt or fly about.

Self-closing Stand Glass.

The glass tubes attached to boilers to show the height of the water break occasionally and permit the hot water and steam to escape. L. Heppner attaches two cocks to cut off the steam, and prevents their closing by a rod of fusible metal placed near the tube, a spring or weight tending to close them both as soon as released. The escape of steam will melt the rod and permit of their closing. The inventor, a Saxon, uses Lipowitz metal, the bar being as long as the glass, and about three millimeters (one-eighth of an inch) wide and thick.

A NEW TEST FOR NITROUS ACID.—Dr. Jorissen uses a solution of fuchsine in glacial acetic acid, in the proportion 0·1 gramme to the liter, as a test for nitrites. Max Vogel used an alcohol solution. At first it turns purple, then blue, afterward dark green, and finally yellow. Nitrates have no effect on this reagent. Free mineral acids also color it yellow finally, but the red color is restored by adding water, which is not the case when it has been acted upon by nitrites. If this test works well in the hands of persons of small experience, and is sufficiently delicate to detect nitrites in well water, it will be a welcome improvement.

To bleach sheespkin parchment white, expose the pieces to strong sunlight under glass in a moist atmosphere.

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ELECTRICITY AS A MOTOR FOR AERIAL NAVIGATION.

M. TISSANDIER gives an account in *La Nature* of some experiments which he has carried on in regard to the propulsion of air balloons by electric motors. Since the commencement of these experiments considerable progress has been made in the construction of accumulators, but the Faure and Planté accumulators, constructed by M. de Kabath, are of considerable weight in comparison with the work which they are capable of doing. It takes but little less than two hundred and fifty kilogrammes of accumulators to produce one horse power. It would not be impossible to construct special accumulators much lighter and of large capacity, but without renouncing in any manner the secondary batteries, M. Tissandier wishes to take into account all that can be obtained from primary batteries of great power. The batteries of large power are but few, numbering three: the Bunsen, the Daniell, and the bichromate of potash battery. The last is the most advantageous in the present case.

After numerous experiments for determining the best composition for the exciting liquid, the nature of the jars, the limit of thickness of the carbons and zincs, the number of the latter in each element, finally to have a maximum power under or below a minimum weight, M. Tissandier constructed a model with a large surface, which has given preliminary satisfactory results. The idea of this model was obtained from seeing the bichromate batteries of M. Trouvé work in his electrical boat, and the first experiments were made with four Trouvé batteries.

The twenty-four elements, mounted in tension, put in motion a small Gramme motor of half a horse power. The work produced measured was 14 kilogrammeters per second during one hour, and 10 kilogrammeters during the following hour. The Gramme motor employed was not constructed to work with these batteries, and the experiment was made under the worst conditions, but it was demonstrated that the bichromate batteries are much more constant than is generally believed. The new model of battery is composed of an ebonite trough, 5 millimeters thick, measuring 0·55 m. in length, 0·16 m. in height, and about 0·14 m. in width. In this trough are placed vertically thirteen carbons and twelve amalgamated zincs, arranged in alternation. The carbon plates are two and a half millimeters in thickness, the zinc plates about one millimeter. These plates are fixed to longitudinal bands of copper, which are screwed upon the exterior edge of the ebonite trough. Notwithstanding its lightness, the elements thus mounted are very solid and may be shaken quite violently without the carbons or zincs being deranged.

The ebonite vessel is furnished with an opening in the lower part to admit a tube which, by the aid of a rubber pipe, communicates with a receiver containing the bichromate solution. By raising or lowering this receiver above or below the battery elements, the battery may be filled or emptied. The battery contains about 4 liters of liquid strongly charged with bichromate and sulphuric acid (the composition of the liquid, in weight, is, water 100 parts, bichromate of potash 16, and sulphuric acid 37). The solution being very concentrated, the electrical resistance is less. The electromotive force of this battery is very variable, and may become considerable when the exterior resistance is very feeble. In an experiment performed with a hot and very concentrated liquid, a mean current of 110 ampères was obtained during twenty minutes with a difference of potential at the limit of 1·68 volts. This represents transferable work equivalent to 18 kilogrammeters per second. The boiling was so violent the liquid escaped outside of the vessel and put an end to the experiment.

This result may be obtained practically, but the returns which may be depended upon in the normal condition of work are favorable enough, and then the battery will be nearly constant from one hour and a half to two hours. We give the figures, from which one may form a correct idea of what may be obtained. These are the mean figures obtained by a series of experiments made upon variable resistances:

A battery of eighteen elements, arranged for tension, weighs 140 kilogrammes. Over a circuit of 0·54 ohm resistance it gives a transferable electric energy of 135 kilogrammeters per second for about one hour and a half with a current of 50 ampères. A motor adapted to this battery will yield better results. The motor weighs about 50 kilogrammes; the results obtained are as follows:

With a weight of 200 kilogrammes, battery and motor, it is possible to produce a continuous and constant work of 100 kilogrammeters per second during one hour and a half.

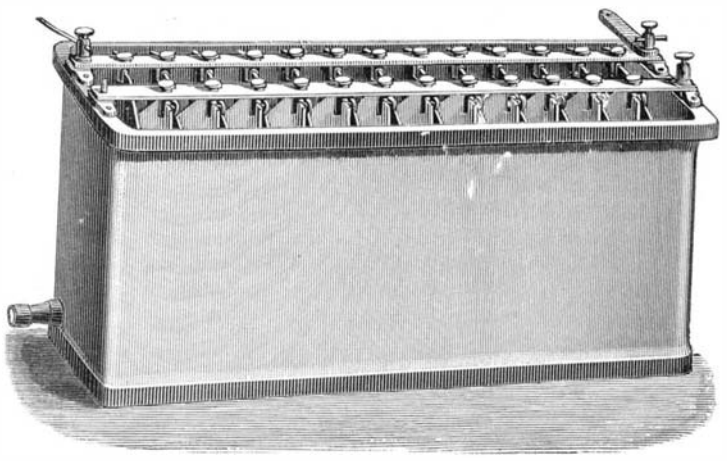
Some experiments already performed show that the production of electricity may be prolonged:

1st. By agitating the liquid; this is facilitated by employing communicating vessels;

2d. By adding new quantities of bichromate of potash to the warm and wasted liquid;

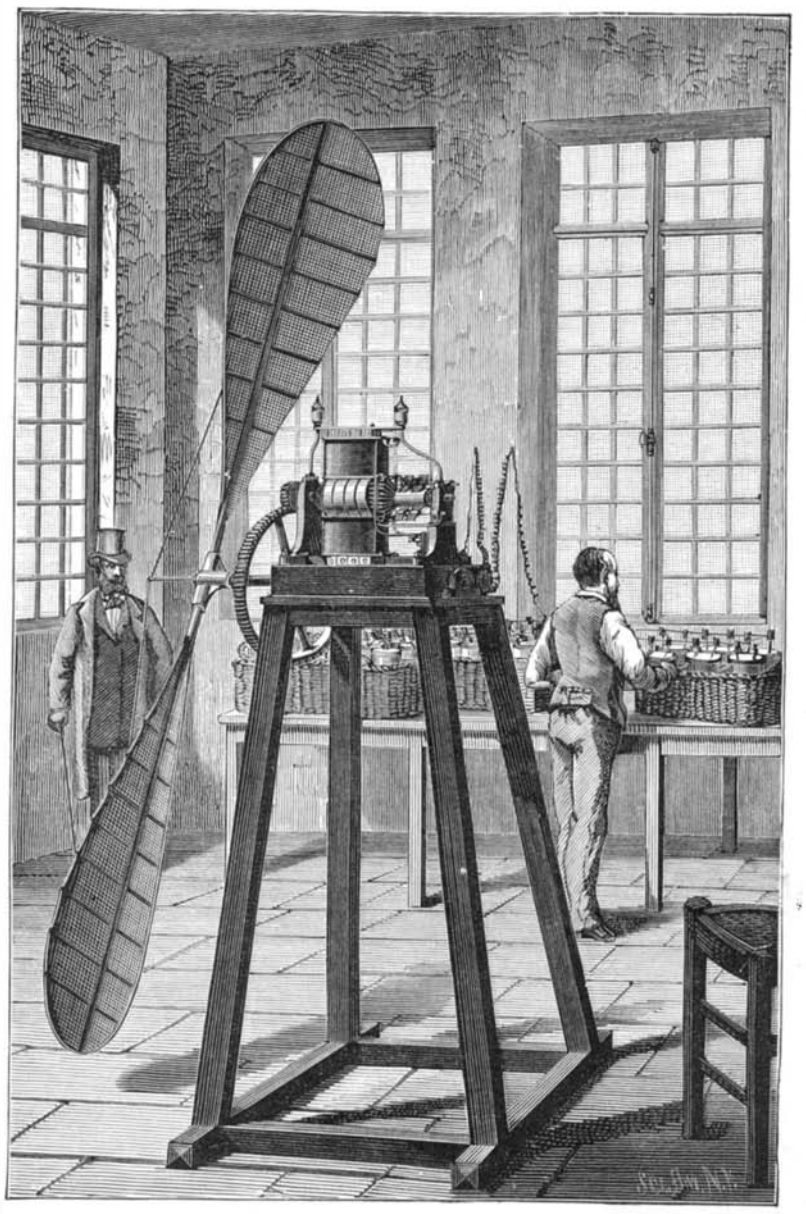
3d. By protecting the negative plate.

A battery of 18 elements, weighing 140 kilogrammes—the weight of two men—will probably furnish for over two hours a work of from one and a quarter to one and a half horse power, or the work of twelve to fifteen vigorous men. A similar battery with its motor may be easily carried by an elongated balloon of small dimensions and of small diameter, and offering in consequence little resistance to the air.



LIGHT BICHROMATE BATTERY.

While testing the power of the battery, M. Tissandier experimented with a screw attached to a dynamo-electric motor. A screw of 2·80 m. in diameter was fixed to a small Siemens dynamo-electric machine, weighing 65 kilogrammes and mounted upon a large stool (Fig. 2). The screw is composed of two plane wings, formed of wooden frames, on which silk, varnished with gum lac, is stretched in such a manner as to form a smooth rigid surface. Slender bands of iron strengthen the wooden arms, and small wires prevent the screw from being put out of shape during its rotation. The wings have an inclination of about thirty-five degrees. The motor was worked by a Faure accumulator, constructed by M. Reynier. The experiments were carried on in the Siemens workshop. With forty accumulators mounted in tension, the screw made one hundred revolutions a minute, the armature of the motor making one thousand.



ELECTRICAL PROPELLER FOR BALLOONS.

Under these conditions it was easy to calculate by the column of air displaced, that the screw worked very energetically. The current of air at from one to two meters from the apparatus was intense, and could be sensibly felt at a distance of ten meters. This fact was authenticated at the Observatory where the system was exhibited.

A Statue Struck by Lightning.

During a thunderstorm, June 22, the Confederate Monument in the State House grounds, Columbia, South Carolina, was struck by lightning, and the marble statue of a Confederate soldier that surmounted it was thrown to the ground. The head was cut completely off at the neck as if with a sword, and falling, struck on the upper base stone of the northern front of the monument. In falling the body struck the lower base on the eastern side, driving it out of place for an inch or two. The cannon at the rear of the statue was broken off. The right leg was severed at the skirt of the coat. The hands, which rested on the musket, were broken off, and the left leg was driven into the ground six or eight inches. There is nothing left on the top of the shaft but a fragment of the left leg, which is broken off at the ankle, and rests upon the broken stock of the musket. The statue was hurled to the ground with so great force that where it struck the stone base it was crushed into powder. Many fragments were carried off by curiosity seekers. The head and hands were deposited in the Secretary of State's office for safe keeping, and the rest of the statue was placed under the guard of the State House keeper.

The monument was erected by the South Carolina Monumental Association, composed of ladies, on May 13, 1879. The association was founded in February, 1865, and work was begun in 1869. The total expenses of the enterprise amounted to $11,761 46. The statue surmounting the monument, which was of fine Italian marble, cost about $5,000.

Progress of Homeopathy.

At the recent meeting of the American Institute of Homeopathy, at Indianapolis, Dr. Talbot, of Boston, read a report showing that there are 7,000 homeopathic physicians and 278 institutions in the United States; 4 national societies report 1,067 members; 26 State societies, 1,783 members; 103 local societies, of which 66 report 2,355 members; 18 clubs, of which 7 report 79 members; 23 general hospitals, of which 18 report 1,268 beds; 15 of these hospitals reported having treated last year 6,675 patients. The cost and value of 11 of these is $770,500. Of 30 special hospitals 15 report 859 beds, and 9 of them treated last year 10,609 patients. The cost and values of these hospitals are $1,106,000. Of 29 dispensatories, 27 reported having treated last year 1,469 patients. To these had been furnished 256,589 prescriptions. Twelve medical colleges have had 1,267 students, and graduated 412 physicians this year, and 5,680 since they were founded.

Some Newly Observed Properties of Glucose.

Among the many fluctuating observations formerly made regarding glucose were the following important ones: first, the reduction of alkaline copper solutions; second, the absorption of alkali in a titered solution. To these Léon Cuisinier adds the following new ones:

If a dilute solution of glucose which is saturated with lime be left standing for a long time, the rotatory power decreases more and more, without passing beyond the light orange color. After a larger portion of its rotatory power has disappeared, only a comparatively small part of the alkali is absorbed. If it is saturated with carbonic acid, it will be found that its power of reducing a copper solution has not perceptibly altered in comparison with what it was at the start, while its rotatory power has disappeared entirely. By this reaction an optically inactive body has been formed which has no action on litmus, but unites with some alkali, and absorbs oxygen with avidity, so that an alkaline glucose solution in a well closed bottle absorbs so much oxygen that there is a considerable reduction of pressure. If a certain quantity of the neutral body is put in an alkaline copper solution, the oxide is immediately reduced to the brown (red?) suboxide. Hence it would seem that the reducing property of glucose is to be ascribed to this neutral body entirely, which is presumably an alcohol from which are derived the various kinds of sugar.

[This is not so surprising, for in 1880 Prof. H. W. Wiley showed that the reducing power bore no constant relation to the rotatory power of glucose.—ED.]

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Cotton-seed Fat as an Adulterant for Lard.

BY JOHN MUTER, PH.D., F.I.C.

This fat (of which I exhibit a specimen) is in some respects peculiar. It is, as you see, not at all unlike lard, being similar in consistence and general appearance. According to my analyses of several samples which I have had submitted to me by firms in the lard trade, anxious to know what it is, I find on an average the following result: (1.) It has an actual density at 100° F. of ·911·5 to ·912. (2.) It yields on saponification 95·5 per cent. of fatty acids, all insoluble. (3.) It is completely soluble in ether and in hot absolute alcohol. (4.) When melted and treated by my modification of Chateau's course, it gives reactions for cotton oil. It is, therefore, evidently the "stearine" separated out during the rectification of that oil. A most striking fact is that, although nicely made to almost the exact consistence of lard at ordinary temperature, and not becoming perfectly fluid under 90° F., yet, after melting, it does not again solidify, but remains a yellow oil, having the distant odor of fine cotton salad oil, until it has been kept at 40° F. for some time, when it again resumes its original appearance. Its detection in lard is happily rendered simple by its high density and by the article not setting so solid as it was at first, after having been kept melted for the purpose of taking gravity. If added to "butterine" it makes the article softer and better looking in winter, and increases the density, but the high insoluble acids then serve to distinguish such a "butterine" from a mixture of fat and butter. Many recent "butterines," which on the density actually show a considerable amount of pure butter, have not a trace, but the error is due to the presence of this cotton "stearine." —*Analyst.*

Enlarged Stereoscopes.

In the *Laterna Magica*, Dr. Liesegang, writing of stereoscopes, refers to Claudet's monster stereoscope, and says the latter possessed over the ordinary stereoscope the great advantages that one had not to strain the eyes to view the picture, and that several persons could see the picture at the same time, and with the improved lantern appliances of today a much better result might be expected than was obtainable with Claudet's instrument. It ought to be enough to place the two halves of a stereoscopic transparency, each in a sciopticon, and to project both pictures upon a matte glass so that they cover each other. Absolute coincidence is, however, impossible, as the two pictures are not exactly alike, their central points being separated in the two halves of the stereoscopic picture by a distance rather greater than that between the average human eyes, and an idea of Almeida's comes in. The two halves of a stereoscopic transparency projected as directed above upon the wall produces an indistinct image, the two pictures not being identical, so Dr. Liesegang would push a red glass in front of one side in the lantern and a green one in front of the other. The observer would then put on a pair of spectacles having a red and a green glass, and would only see the green picture through the green eye of the spectacle and the red picture with the other. Almeida maintains that by this means the relief is very well brought out, particularly if the observer bend sideways toward the wall.

The Population of New York City.

A special table has been prepared by the Census Bureau showing the population of New York city by ages, sexes, nativities, etc. The total population (for 1880) is 1,206,029. The native white population consists of 349,250 males and 359,158 females, making a total of 708,408. The foreign white population numbered 231,458 males and 245,707 females, making a total of 477,165. The colored population consisted of 9,536 males and 10,920 females. The number of children of five years of age and under is as follows: Native white, males, 80,739, females, 79,875; foreign white, males, 2,318; females, 2,384; colored, males, 1,012; females, 962. Total males, 84,069; females, 83,221, or a grand total of 167,290 children five years and under. Between the ages of 5 years and 20 years the figures were as follows: Native white, males, 138,399; females, 145,103; foreign white, males, 18,729; females, 22,016; colored males, 1,722; females, 2,001; total males, 158,850; females, 169,130, or a grand total of 327,980. Of the persons 90 years old and over the native white numbered 18 males and 48 females; the foreign white were 63 males and 200 females, and the colored were 1 male and 16 females, making a total of 346 persons reported to be 90 years of age and over. The oldest native white man was 98 years, while there were 3 native white females reported at 98, 2 at 99, and 1 at 100 years. Of the foreign white population, 6 males and 13 females were reported at 100 or over. The oldest colored man was reported to be 94, and 9 colored women were reported to be 100 years or over.

The Last of the Jeannette.

A dispatch from H. H. Gilder, correspondent of the *Herald* in Northern Siberia, describes the finding the bodies of De Long's party by Lieutenant Melville, March 23. The bodies were in two places, 500 and 1,000 yards from the wreck of a scow, at a place passed by Nindermann and Noros, the day after they were sent forward for relief. The natives with the search party first found two bodies under eight feet of snow close by where a gun barrel was found supported by four sticks. While these men were digging toward the east Melville went on along the bank, twenty feet above the river, to find a place to take bearings. He then saw a camp kettle and the remains of a fire about a thousand yards from the tent, and, approaching, nearly stumbled upon De Long's hand sticking out of the snow about thirty feet from the edge of the bank. Here, under about a foot of snow, they found the bodies of De Long and Ambler about three feet apart, and Ah Sam lying at their feet, all partially covered by pieces of tent and a few pieces of blanket. All the others except Alexia they found at the place where the tent was pitched. Lee and Koch were close by in a cleft in the bank toward the west. Two boxes of records, with the medicine chest and a flag on a staff, were beside the tent.

None of the dead had boots. Their feet were covered with rags, tied on. In the pockets of all were pieces of burnt skin and of the clothing which they had been eating. The hands of all were more or less burned, and it looked as if when dying they had crawled into the fire, Boyd lying over the fire and his clothing being burned through to the skin, which was not burned. Collins's face was covered with a cloth.

All the bodies were carried to the top of a hill 300 feet high, about forty versts to the southwest from where they were found, and there interred in a mausoleum constructed of wood from the scow, built in the form of a pyramid twenty-two feet long and seven high, surmounted by a cross twenty-two feet high and a foot square, hewn out of driftwood, and conspicuous at a distance of twenty versts. The mausoleum was covered with stones and is to be sodded in the spring. The cross is inscribed with the record and names of the dead, cut in by the search party.

After completing the tomb the party separated to search the delta for traces of Chipp's people. Melville went to the northwest part of the delta and west as far as the Olenek River; Nindermann took the center, and Bartlett the northeast. Nindermann and Bartlett found nothing. Melville had not returned. The search was to be extended to Cape Borchaya and the bay of that name.

The probability is that Chipp's boat was foundered in the gale which separated the three boats, and that no vestige of the party will ever be found. It also appears certain that De Long's party were all dead long before it would have been possible for Melville to reach them after meeting Noros and Nindermann, had he been able to continue his search in November.

Capacity of Dry Grain for Moisture.

The claim that grain absorbs moisture enough on a sea voyage to pay the freight charges has been verified by some test experiments made at the California Agricultural College. Various kinds of grain were placed in a moist atmosphere and the increase in weight was noted.

The greatest increase was during the first twenty-four hours, the absorption being nearly 33 per cent of the total absorbed during the fifteen days' exposure. The following table shows the figures:

	First 24 HOURS.	*Total* IN 15 DAYS.
Oats	2·79 per cent.	7·70 per cent.
Barley	1·45 per cent.	7·00 per cent.
Wheat	2·45 per cent.	6·56 per cent.

From the results obtained it was computed that perfectly dry grain at 65° Fah. would absorb as follows: Oats, 29·08 per cent; barley, 28·17 per cent; wheat, 25·02 per cent. Under ordinary conditions the percentage is perhaps not so high, 15 to 16 per cent probably being the average.

A Street Car Fare Conveyor.

Some of our city street car lines have introduced a device to save passengers trouble in paying their fares. It is a flat brass tube faced with glass running the length of the car and ending in the usual fare box. In the top of the tube are openings large enough to receive small coins, which as they roll down the tube are visible through the glass.

Wells Comet Seen at Midday.

Successful observations of the Wells comet were made at the Dudley Observatory, Albany, N. Y., June 11 and 12, at the meridian transit. The comet was seen to have a bright, perfectly round, and sharply defined nucleus. The apparent diameter of this nucleus is about three-quarters of a second, or, after allowing for irradiation, about 200 miles. The observation, June 12, shows that the comet was still increasing in brightness, and that the vapors which surrounded the nucleus were becoming more dense and abundant. The observations also proved the Dudley Observatory ephemeris to be remarkably accurate.

THE WIDEST GAUGE RAILWAY.—Washington Territory boasts the widest gauge railway yet reported. It is an 8 foot gauge logging road running back from Skagit River. The rails are wood, 8 by 8 inches. The cars are large and are carried on twelve wheels, of 9 inch face, with double flanges.

THE wrought iron columns made by the Phœnix Iron Works for the Albany bridge are said to be the largest ever made. The length of each is 53 feet 3⅜ inches. Each is composed of eight segments, the iron of which is 1 9-16 inches thick. Each column requires 894 steel rivets, and the weight complete is 18,806 pounds. The square inches of section are 104. The eight columns, therefore, contain 150,448 pounds of metal and 7,152 rivets.

Practical Instructions for Coloring and Pickling Gold Alloys.

BY E. SCHLOSSER, OF VIENNA.

Gold alloys, particularly those that contain copper, acquire, through repeated heatings that take place during their manufacture, an unseemly brown or brownish black color, caused by the oxide of copper. To remove this they are boiled or pickled in very dilute sulphuric or hydrochloric acids, according to the color that they are to have.

If we have an alloy containing only gold and copper, either sulphuric or hydrochloric acid is employed, for gold is not attacked by either of them, while the oxide of copper dissolves so easily that after the pickling the articles have the color of pure gold, for the surface is covered with a thin film of gold.

If the alloy consists solely of gold and silver, the liquid employed is nitric acid, and the articles are left in it only a very short time; the acid dissolves a very small quantity of silver, and hence the articles acquire the color of gold.

If the alloy contains both copper and silver, besides the gold, the method of pickling can be varied to suit the color that it is desired to give to it. If, for instance, it is put in sulphuric acid, the copper alone is dissolved, and the color obtained is that of an alloy of gold and silver, for the surface consists of these two.

If nitric acid were used, both copper and silver would be dissolved, and in this case the color obtained would be that of pure gold.

The articles are gently heated and allowed to cool again before boiling. The object of the heating is to destroy any grease or dust that adheres to it. If they are soldered with soft solder, they cannot, of course, be heated, and must be cleansed from grease and dust by first putting them in a very strong lye, then washing with water and putting them in the acid.

The acids are used dilute, usually in the proportion of one part of concentrated acid to forty parts of water. The articles are laid side by side in a porcelain or earthenware dish and the dilute acid poured over them. From time to time one is taken out to see if they are yellow enough yet. When the proper color has been reached they are washed in clean water and dried.

While this pickling is merely to bring out the color of the gold, the coloring of gold has for its object the imparting to inferior goods the appearance of very good gold. Different mixtures can be employed for coloring gold, two of which are given below as giving very good results.

Mix together two parts of saltpeter, one part of table salt, and six parts of alum, with six and a half parts of water, and warm the mixture in a porcelain vessel. As soon as it begins to rise add one part of hydrochloric acid, and bring the contents of the vessel to a boil, stirring it the meantime with a glass rod.

The articles to be colored, suspended on hooks made of strong platinum wire, or of glass, are first dipped in sulphuric acid and then put in the slowly cooking solution last described and moved to and fro in it. In about three minutes they are taken out and dipped into a large vessel of water so as to see what color they are. If the desired shade is not yet attained they are dipped in again as often as necessary until they do have it. In the subsequent dippings they are only left in the liquid for one minute.

Articles colored in this way have a light yellow color, but matte appearance. They are repeatedly washed in water to remove the last trace of the liquid, and then dried in soft sawdust that has been warmed.

Instead of drying in sawdust, they can be dipped in hot water the last time and left in there a few seconds, and when taken out the water that hangs on them will evaporate almost instantly.

The second method of coloring gold alloys is by means of a mixture of 115 parts of white table salt and 230 parts of nitric acid with enough water added to dissolve the salt. This is boiled down to a dry mass of salt. The salt is put in a porcelain dish and 172 parts of fuming hydrochloric acid poured over it and heated to boiling. As soon as the suffocating odor of chlorine is perceived the articles to be colored are dipped in, and the first time they are left eight minutes in the liquid. In other respects the treatment is the same as above described. Articles that had been polished previously do not require polishing again. Of course care must be taken not to inhale this dangerous gas; the operation must be conducted under a draught or out of doors.

N. E.

A VALUABLE GRAPE VINE.—A scuppernong vine in the Tokay vineyard, near Fayetteville, North Carolina, bears 100 bushels of grapes a year. There are other vines in the same vineyard which produce from 25 to 40 bushels. The vines were planted twenty-five years ago.

Why the Wells Comet has no Tail.

The failure of the Wells comet to develop the tail expected by astronomers is accounted for by the absence of hydrocarbons from its composition. According to spectroscopic observations made at the observatory of Lord Crawfurd, in Scotland, the nucleus of the comet is unlike that of any comet previously examined, its chief element being sodium, with indications of iron and chlorine. These elements are much less volatile than the hydrocarbons found in all other comets.

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RECENT INVENTIONS.

Safety Plug and Valve for Boiler Fittings.

The object of the invention shown in Fig. 5 in the accompanying cut is to prevent injury and loss of life from the breaking off of cocks, valves, or pipes that are used in connection with steam boilers, and is a safety plug and valve for cutting off the steam automatically in case the valves or cocks become broken. A is a tubular plug, formed with an external thread at one end, for tapping into a boiler plate in the usual manner, and it has also an external thread at its outer end, for the attachment of a valve or cock. The aperture of the plug is tapered at its inner end to form a valve seat. B is a valve of tapering form, and provided with a stem that extends through an aperture in a guide yoke, as shown in the engraving; the yoke serving to retain the valve central, and is attached to a ring that is fitted in a recess in the end of the plug. To the inner end of the valve is attached a wire that extends to near the outer end of the plug, where the wire is formed with an eye, and is secured by a screw-pin fitted crosswise of the plug and passing through the eye. The valve and wire are so adjusted that the pin retains the valve off its seat at the inner end of the plug, and the valve being held open, the ordinary use of the valve attached to the plug is not interfered with. In case the outer valve is knocked off or broken, the projecting end of the plug, A, will also be broken, and the wire will be released, and the steam pressure will close the valve, B, on its seat. The safety-valve can be conveniently used to close the plug when it is desired to remove the fitting. The invention has been patented by Mr. John J. Mackedon, of Omaha, Neb.

A New Lifting and Force Pump.

A pump adapted to be used in either open or driven wells for all ordinary purposes, also for extinguishing fires, sprinkling streets, etc., is shown in the annexed cut in Figure 1. It is the invention of Mr. Moses Gayman, of Canal Winchester, Ohio. The water chamber may be made of iron or wood. If made of wood the side openings will be faced with flanged and internally threaded metallic thimbles, and the central opening will be faced with an externally threaded collar, which is provided with an annular screw-cap, which, with the collar, forms the stuffing box of the valve rod. In the thimble, at one side of the box, is screwed an air chamber, and at the other side is screwed the discharge tube. In the opening on the under side of the chamber, and which registers with the opening for the valve rod, is secured by braces, as shown, a large pipe in which the bucket on the end of the valve rod works. To the lower end of this pipe is secured the bottom pipe, and on the upper end of this pipe is placed a flap valve. The lower end rests on the bottom of the well and supports the pump. If the pump is to be double-acting, an inverted, elongated, cupped sleeve, E, is placed on the valve rod, and moves with it, and diminishes the space in the water-chamber, and forces the water through the discharge pipe.

Bag Fastener.

The device represented in Fig. 6 of the accompanying cut is a bag fastener that is easily applied, well adapted for outdoor work, and will securely fasten a bag, even if it has no hem, without the risk of slipping. A, B, are two bag receiving arms or jaws, made of malleable iron, that are hinged at one end with a joint pin, arranged to pass through a slightly inclined slot in the jaw, B, to provide for a longitudinal movement of the jaws. Either or both of the jaws may be corrugated, on their inner sides, to give a better hold upon the bag. The jaw, B, when closed upon the bag, enters at its opening end, between the cheeks of the corresponding end of the jaw, A, and has at this end a locking projection that engages with a locking lever that is fulcrumed on the end of the jaw, A; the arrangement of the locking projection and locking lever being such that the lever is prevented from flying back from the pressure against the inner edges of the jaws (when the bag is closed). The bag is opened by simply raising the lever and moving it back. This device, which securely locks the bag, may be applied to a bag without a hem, or to any part of it, and is not liable to slip. This fastener is patented by Mr. Charles W. Bradford, of Belfast, Me.

Wedge Driver.

The object of the invention shown in Fig. 7 of the accompanying cut is to provide a new and improved apparatus for driving wedges, especially adapted to be operated by horse power. The device is patented by Mr. Otto Mossberger, of Guttenberg, N. J. The invention consists in a vertically reciprocated hammer, connected by adjustable connecting rods and cranks, with a collar loosely mounted on a shaft, provided with a fixed cog-wheel, and rotated by means of an intermediate train of gear-wheels that engage with a circular rack, mounted on a wagon frame, and adapted to be rotated by horse power. The loose collar is provided with an automatically operating clutch device, which engages it with a fixed cog-wheel on a rotating shaft. By this means the hammer is raised and then released automatically, when it has reached its greatest height. The machine is especially adapted for driving wedges into stumps, for the purpose of splitting them, but it can be used also to drive drills, or to drive posts or spiles.

Seed Planter, Coverer, and Fertilizer.

We find among recent patents a new combined seed planting, covering, and fertilizing machine, invented by Mr. Lewis S. Hefner, of Sparkling Catawba Springs, N. C. The machine is shown in Fig. 4, in the annexed cut, in which is a plow of the usual construction of beam, standard and handles. Near the outer end of the beam, between its lower face and the upper face of a block bolted to its under side, is journaled an axle that is cylindrical in its middle and has squared ends. One of these squared ends passes through a square hole in a wheel which rests on the ground, supporting the plow beam and revolving the axle, to the opposite end of which is attached a band pulley; the wheel, axle, and band pulley all revolving with the forward movement of the plow. A band passes over this pulley, and its upper portion passes thence around a pulley on the axle of the dropping wheel, K, from which it passes over a guide pulley back to the driving pulley, revolving the shaft of the dropping wheel and dropping the seed. By using band pulleys of different diameters the distance apart of the seed can be regulated. The dropping wheel is directly under the hopper, and has a recess on its circumference, having one edge cut away. In this recess is inserted a plug, leaving a space between it and the cutaway surface, the size of the opening being graduated by the size of the plug, thus regulating the quantity of seed dropped. The seed is covered by two coverers, one provided with a right and the other with a left share, secured to their ends, and may be readily adjusted, so as to cover deep or shallow as may be desired.

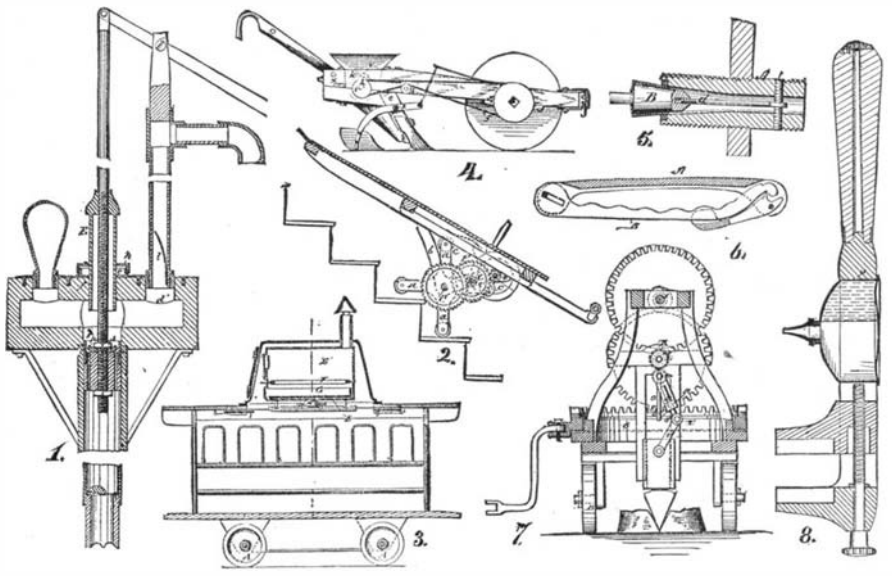

Fig. 1. Gayman's Lifting and Force Pump.—Fig. 2. Tauber's Stair Truck.—Fig. 3. Kirkpatrick's Car Heater.—Fig. 4. Hefner's Seed Planter.—Fig. 5. Mackedon's Safety Plug.—Fig. 6. Bradford's Bag Fastener.—Fig. 7. Mossberger's Wedge Driver.—Fig. 8. Kinsman & Merrill's Wrench and Oiler.

Improved Stair Truck.

Among the late inventions we find an improved stair truck, by means of which heavy burdens may be easily carried up or down stairways, without danger of marring or in any manner injuring the stairs, and without the necessity of providing tracks or tackle of any kind. The invention consists principally of a wheel provided with extensions or arms, adapted to be revolved by suitable gearing or mechanism attached to the truck, for elevating or lowering the truck and burden from stair to stair. The wheels may have four or more arms, and at the ends of the arms casters can be attached if desired. The wheels are secured upon an axle that is journaled in downward extensions of the truck body. Near the center of the axle is a fixed cog wheel, that meshes into, and is operated by a train of gearing driven by a crank shaft. By this means the wheels of the truck are revolved, their arms reaching from stair to stair, and causing the truck, with its load, to ascend the stairway. In descending the stairs with a load, to prevent its going too rapidly, the side-bar of the truck is provided with a pivoted brake, which bears against the crank-wheel. When the truck and load are to be moved over a level surface, the caster wheels permit the load to be easily moved. This device, shown in Fig. 2 of the annexed cut, is the invention of Mr. Johann C. Tauber, of Plain City, O.

Combined Carriage Wrench and Oiler.

This invention is patented by Messrs. Prescott B. Kinsman and Josiah Merrill, both of Great Falls, N. H., and is shown in the annexed cut at Fig. 8. The stock of the wrench is flattened in width and formed with a circular opening near its handle end, and also with a longitudinal slot extending from the circular opening to the fixed jaw at the head of the wrench. The walls of this serve to support and guide the movable jaw of the wrench, which is adjusted to or from the fixed jaw, by means of a screw that passes through the fixed jaw, and is held to it so that its shank is free to turn, by a head on the outside, and a fixed washer on the inner side of the jaw. The threaded portion fits into a corresponding threaded perforation in the movable jaw. The oiler is of ordinary construction, with a spring bottom for ejecting the oil by the pressure of the thumb, and is placed in the circular opening near the handle, and secured in any suitable manner. The wrench and oiler will be found a useful appendage to any carriage, and occupy but little room, and will be always at hand.

Heater for Cars.

A new heater for cars has lately been patented by Mr. David M. Kirkpatrick, of Kansas City, Mo. This heater is especially adapted to warming street cars, but may be applied to all kinds, and provides for heating them without obstructing the seat space or floor of the car. The device is shown in the annexed cut, in Fig. 3. The middle part of the roof of a street car is cut away, and in the opening thus formed is secured a bed plate that is attached at its four corners to the roof and supports the heater. The sides and ends of this plate are recessed to allow the heated air to come into the car. E is a stove of ordinary construction, and has formed on its bottom plate a conical pivot, made broad, to serve as a foot to rest upon the belt plate, to which it is secured by a two part collar, the inner surface of which is made conical to fit the pivot. The stove is further supported by two studs attached to the forward and rear part of the stove bottom, the lower ends of which rest in grooves formed in the bed plate. The stove may be turned on its pivot when the horses are changed from one end of the car to the other, to keep its forward end toward the forward end of the car, so that the draught will operate properly. The stove and the opening in the roof of the car are covered with an arched cover, that is attached to the bottom of the stove, so that it will be carried around with it when it is turned on its pivot. When the stove is in line with the car the edge of the cover rests in a packed groove, making the joint between the cover and the roof tight. The heated air from the stove presses down and circulates through the interior of the car, and should the car be thrown from the track and overturned the stove will be thrown from the car and the danger from fire be avoided.

Effects of Too Much Brain Work for Children.

On April 28, Dr. Richardson, F.R.S., delivering a lecture on "National Necessities as the Bases of Natural Education," before the Society of Arts, brought forward, writes F. C. S., the following extract, which happened to be a report of the chairman of the evening, Mr. Edwin Chadwick, C.B., to the British Association in 1860, to show what an evil effect too much brain work, without a proportional amount of industrial occupation to support it, has upon young children:

"In one large establishment, containing about six hundred children, half girls and half boys, the means of industrial occupation were gained for the girls before any were obtained for the boys. The girls were therefore put upon half time tuitions; that is to say, their time of book instruction was reduced from thirty-six hours to eighteen per week, given on the three alternate days of their industrial occupation, the boys remaining at full school time of thirty-six hours per week, the teaching being the same, on the same system, and by the same teachers, the same school attendance in weeks and years in both cases. On the periodical examination of the school, surprise was expressed by the inspectors at finding how much more alert, mentally, the girls were than the boys, and in advance in book attainments. Subsequently industrial occupation was found for the boys, when their time of book instruction was reduced from thirty-six hours a week to eighteen; and after a while, the boys were proved, upon examination, to have obtained their previous relative position, which was in advance of the girls."

A New Use for Old Tin Cans and Scrap Tin.

According to the *Berg- und Huettenmannische Zeitung*, a better method for utilizing old tin cans than simply to melt off the solder has been devised. E. Rousset first heats the tin, old or new, in an oxidizing flame, which burns up all the pure tin and that combined with iron. When this is stopped the scraps of iron are seen to be covered with a brown and brittle crust, the upper layer consisting of oxide of tin, the lower of magnetic oxide of iron. It is passed through rollers and then forms a powder that contains both oxides. The iron that remains after sifting out the powder makes good wrought iron or cast iron, but is particularly fitted for precipitating copper. The oxide of tin, although mixed with oxide of iron, can be easily worked into tin, and the metal obtained from it is free from sulphur and arsenic. But will it not contain traces of lead?)

$350 a Square Foot.

The building and lot at the southwest corner of Wall and Broad streets has changed hands at $168,000. The property has a frontage of 16 feet on Broad street, and a depth on Wall street of a trifle over 29 feet, and the building upon it is a plain five-story brick building.

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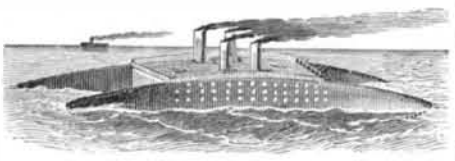
MECHANICAL INVENTIONS.

Construction of Vessels.

An improvement relating to the construction of vessels, by which the inventor claims to attain greater speed, stability, and safety than is obtained in vessels of ordinary construction, is patented by Mr. William Coppin, of London, England. The invention is shown in the annexed cut, and consists of a compound ship, composed of three ship-hulls united as one vessel, the two outer hulls being longer than the central, and the whole being decked over. The outer hulls are of narrow beam and equal length. The three hulls are rigidly connected in such a way as to form complete decks, and so as to leave considerable extra spaces between the hulls. The center hull is to carry the engines, and is provided with a propeller at each end. This arrangement brings the screws well toward the longitudinal center of the outside hulls, and prevents the pitching motion of the vessel from lifting the propeller out of the water. All of the hulls are tapered vertically and longitudinally, and come to a rounded point at both ends, so as to enter the waves and reduce the pitching motion, the rolling motion being done away with by the extent of the water spaces between the hulls. These improvements are especially applicable to war ships, as their stability enables them to carry a large amount of armor-plating, and their breadth gives an extended battery platform and complete protection is given to the engines, propeller, and steering apparatus, and the construction is such that one of the vessels might be completely riddled by shot and yet be supported by the other two. The light draught gives greater facilities for maneuvering and for entering harbors.

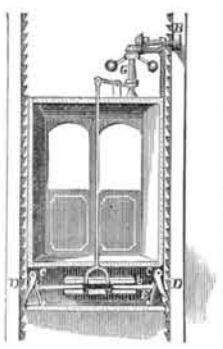


Waste Valve for Pumps.

The invention shown in the annexed engraving, and patented by Mr. Jerome Giles, of South Bend, Ind., is an improved waste valve for pumps, that is simple, inexpensive in construction, and efficient in use, and can be applied to all kinds of pump-tubing. In the engraving, A is the valve-plate, to which a packing of sole leather or other suitable material is secured by a bolt upon which the valve is pivoted and secured to the pump tube, over a small orifice for the escape of the waste water. The plate, A, is struck up from metal not subject to oxidation in water, and has flanges to form a recess for the packing to rest in, and a lug to come against the pump-tube to limit the movement of the valve on its pivot, B. The valve is cut away so as to form a passage, C, for the waste water from the pump, that permits the water to escape when the valve is turned so that its passage registers with the orifice of the pump-tube. The parts of the packing on either side of the passage serve to close the orifice when the valve is moved up or down from the position that opens the orifice.

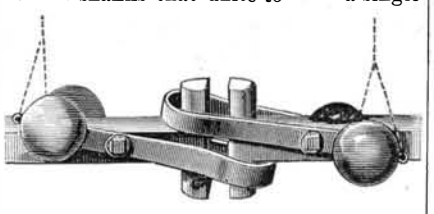
Safety Attachment for Elevators.

Among the many inventions for the prevention of accidents in elevators by the breaking of the lifting rope, or other causes, is the device illustrated by the annexed engraving. The inventor combines with the car of an elevator a centrifugal governor, G, to which motion is imparted by a driving wheel, B, which may be either geared to a rack extending the length of the shaft in which the cage moves, or by friction contact with a plain surface in the shaft. The cage is provided with two or more pawls, C, on opposite sides of it, and which ordinarily hang clear of corresponding notches in the upright shafts, D, but when used are operated by springs, as hereinafter shown. When the cage moves too rapidly down the action of the governor is quickened by the accelerated motion of the driving wheel, and the rod, *a*, is raised, liberating the rods, *b b*, and the springs, E E, which are attached to them, which then act upon the pawls, C, and hold them in locking contact with the uprights, D. To avoid undue wear on the governor it only has motion imparted to it during the descending motion of the cage, and is at rest when the cage is ascending. The above device is patented by Mr. Adam Hafner, of Eatonton, Georgia.



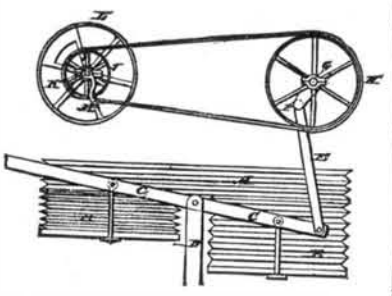
Car Coupling.

A simple and effective car coupling has been recently patented by Messrs. Jean Billon, James Billon, and Henry L. Berger, of St. James, La., and is shown in the accompanying drawing. A car is provided at each end with a projecting draw-head that has at its outer end a vertical transverse block or head projecting upward and downward from the end of the draw-head. A U-shaped shackle, made of metal rod or flat bar, is pivoted at its middle to the middle of the draw-head, in such manner that the rounded end of the shackle can swing outside of the vertical block on the end of the draw-head. Weights of any suitable kind are attached to the open ends of the shackles which tend to hold the shackle in a vertical position, and chains are also attached to the ends of the shanks that unite to form a single chain that is secured to a pivoted lever on the top of the car, the inner end of which can be held to the roof by a hook or other suitable device. If the lever is raised the weights draw the inner ends of the shackles down so that the closed end will project upward from the draw-heads. When the ends of the draw-head come in contact, the end of the lever on the top of the car is depressed, and the shackle is swung over the cross heads until it rests on the upper side of the draw-head, when the lever on top of the car is secured by the hook and the shackle locked in position on the draw-head. To uncouple the car the lever is released from its hook, and the weights carry the forward end of the shackle upward and the cross-head is released, uncoupling the cars.



Mechanism for Working Organ Bellows.

A device, by which a steady and uniform motion may be given to organ bellows, and that can be worked with a much less expenditure of power than when the bellows are worked by means of a hand lever, as is usual, is illustrated by the accompanying engraving. The wind chest and bellows of the organ are of ordinary construction. A lever, C, that is pivoted to a post, D, or other suitable support, is connected with the bellows, B, upon the opposite sides, and at equal distances from its fulcrum. To the lever is also pivoted the lower end of a connecting bar, E, the upper end of which is attached to a crank, F, upon a shaft, G, that is secured to suitable supports, and has attached to it a large pulley, H, around which passes a belt. This belt passes around a smaller pulley, J, attached to a shaft, to which is also secured a flywheel, L, that is driven by a crank, M, attached to its shaft, the shaft working in bearings attached to suitable supports. The machinery is simple, and has the following advantages: its action is regular, and does not subject the bellows to the same wear and tear as the lever, and enables organ turners to turn with more facility; it is so cheap that all churches can afford to introduce it; it occupies only a small space, and can be attached to any bellows; organists can play more delicate pieces and produce finer harmony, and the man who works the bellows will not have his Sunday turned into a week-day of hard labor. We understand this device has been introduced in a number of churches, and is giving good satisfaction. The mechanism has been recently patented by Mr. Julius Wagner, of Reading, Pa.



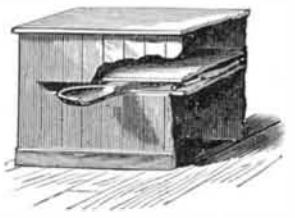
MISCELLANEOUS INVENTIONS.

Feed Bag for Horses.

Mr. Frank Wheaton, of Brooklyn, E. D., N. Y., has patented an improvement in feed bags for horses, the object of which is to provide a device for suspending a feed bag from the head stall of a horse's harness, so made that the horse can reach the bottom of the bag without being chafed by the straps supporting the bag. The device is shown in the annexed drawing. The head-stall, provided with a nose band, has a ring attached to each end, and a leather disk is also attached at the same place on the inner surface, the rings resting on the disk and the disks resting against the sides of the horse's head. A ring is fastened to each side of the feed bag, and to these rings the ends of a strap or rope are attached, that passes from the outside to the inside through slots in the bag above the loop, and then passes through one of the rings on the end of the head stall, around the upper ends of the hames, through the loop of the other end of the head stall, and to the ring on the other side of the feed bag. The feed bag is thus suspended from the hames by the strap, and if the horse moves his head downward the bag will be drawn upward, and the horse can get to the bottom of the bag, and as soon as the horse raises its head the bag will descend, and the horse can take its nose out of the bag, as horses like to do when feeding. In this device the strap is not bent at acute angles, but at every point at an obtuse angle, whereby the friction is materially diminished and the strap is not apt to crack or break. The disks also prevent chafing the sides of the horse's head.

Store Counter Seat.

A useful and humanitarian invention, which consists of a store counter seat that is adapted to be applied to the front of the counter for the use of customers, or the rear side for the attendants, is shown in the annexed cut, and has been recently patented by Mr. Andrew J. Culbertson, of San Andreas, Cal. The store counter is provided with a horizontal recess formed by horizontal partitions, placed at a suitable distance below the counter top. A seat made of any suitable form has formed with it an arm extending from it in a radial direction. At or near the junction of the seat and arm is attached a box, that carries a coiled spring, one end of which is attached to the box, and the other to a shaft or arbor, which forms the pivot of the seat. In a groove in the bottom of the recess is a spring lever, the outer end of which extends beyond the recess, to be reached by the hand, and the inner end is secured at the inner end of the groove.



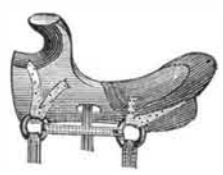
Between the fixed and free ends of the bar is a depression between two shoulders, the distance between the shoulders corresponding with the width of the arm of the seat. When the seat is not in use it lies in the recess where it is held in place and prevented from turning by the engagement of the shoulders of the elastic lever referred to above. When the seat is needed the elastic lever is depressed, when the arm is released, and the coil spring in the case in its effort to uncoil causes the seat to swing outward against a stop or abutment which prevents further rotation.

Improved Fish Hook.

The accompanying engraving shows a novel combination of fishing hooks and a baiting pin, which will strike lovers of the piscatorial art favorably. The object of the inventor is to provide a fish hook or cluster of hooks, on which a live bait may be securely and easily fixed by means of a baiting needle, the construction and arrangement being such that a trolling spoon may be easily adjusted when desired instead of the living bait. In the engraving is shown a duplex barbed fish hook, A, having secured to it, and between its shanks, one part of a bent baiting needle, one end of which terminates in a hook serving to hold and clasp the lower end of the needle, when it is pressed into the hook and prevents the escape of the bait. A trolling spoon, having suitable hooks or staples, may, if desired, be quickly adjusted and securely held on the baiting needle in the place of the living bait. This device is patented by William E. Hemming, of Redditch, England.

New Saddle Tree.

Mr. William Madison Mann, of Helena, Montana Territory, has made a useful improvement in that class of girth attachments to saddle trees in which two leather straps, provided with girth rings at their ends, are wrapped one around the horn and the other around the cantle of the tree. The objection to this, which is the ordinary saddle used by the herders on the Western plains, is that the cumbrous leather straps and rings by which they are connected to the two girths passing under the belly of the horse are in the way of the rider, and the one wrapped around the horn of the saddle becomes quickly worn through by the lasso wrapped around it and the horn. These defects are ingeniously remedied by the inventor by dispensing with the leather straps wrapped around the horn and cantle of the saddle, and substituting therefor, on each side of the tree, two bifurcated metallic strips, riveted or otherwise secured to the tree and not extending over the horn or cantle. This construction is cheaper and more durable than the old one, the forked straps acting as braces, and the horn is left entirely free for wrapping the lasso around it. The invention is clearly shown in the annexed engraving.



Folding Cotton Basket.

George W. Starr, of Vicksburg, Miss., has patented an improved cotton basket. The annexed engraving is a perspective view, giving a clear idea of the invention. A tube, A, made of pliable material, is attached to a top hoop, B, and to a bottom hoop, C. The bottom hoop is bent at opposite sides and U-shaped plates are fastened to it by rivets. The round end of the bails of the basket correspond with the U-shaped plates on the bottom. The bottom of the basket may be made of wood, metal, or canvas. When the basket is used the round end of the bails are passed into the U-shaped sockets, holding the basket in a raised position, as shown in the engraving. The cotton is filled into and pressed down in the basket, and as it gradually becomes filled the bails are drawn out of the sockets. They may be now thrown up and used to pass over the scale hook for weighing instead of hooking into the sack as is usually done. These baskets may be folded very compactly and a large number of them may be stored conveniently.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Cotton and Rubber Belting, Leather Belting, Soapstone Packing, Empire Packing. Greene, Tweed & Co., N. Y.

Pure Water furnished Cities, Paper Mills, Laundries, Steam Boilers, etc., by the Multifold System of the Newark Filtering Co., 177 Commerce St., Newark, N. J.

For Sale.—New 23½" by 14 ft. Engine Lathe. Latest design. Rod and screw feed and compound rest. $650. S. M. York, Cleveland, O.

Red Jacket Adjustable Force Pump. See adv., p. 13.

American Fruit Drier. Free Pamphlet. See ad., p. 13.

72" Independent 3 Jaw Chucks, $42; 48", $36; 24", $30. *Warranted* best in the world, and sent on trial. American Twist Drill Co., Meredith, N. H.

Ball's Variable Cut-off Engine. See adv., page 13.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

Peck's Patent Drop Press. See adv., page 356.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Co., Buffalo, N. Y.

Paragon School Desk Extension Slides. See adv. p. 13.

Brass & Copper in sheets, wire & blanks. See ad. p. 14.

Cope & Maxwell M'f'g Co.'s Pump adv., page 13.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 15,000 Crank Shafts, and 10,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Machine Diamonds, J. Dickinson, 64 Nassau St., N.Y.

Eagle Anvils, 10 cents per pound. Fully warranted.

Railroad Supplies. Manufacturers' and Polishers' Supplies. Send for catalogue. Greene, Tweed & Co., N.Y.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 13.

Something new and interesting in Stemwinding Permutation Locks. See adv. of D. K. Miller Lock Co., p. 14.

Fine Taps and Dies in Cases for Jewelers, Dentists, Amateurs. The Pratt & Whitney Co., Hartford, Conn.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 14.

Supplee Steam Engine. See adv. p. 13.

Lightning Screw Plates, Labor-saving Tools. p. 402.

Malleable and *Fine* Gray Iron Castings to order, by Capital City Malleable Iron Co., Albany, N. Y.

New Engine Lathes for sale, for instant shipment; 18 and 20 in. swing; 6 to 10 ft. bed; modern improvements. Forsaith & Co., Manchester, N. H., or 209 Center St., N. Y.

Wanted—Superintendent for Malleable Iron Works. One familiar with running blast or air furnace preferred. Address "M. I. W.," 2116 Market St., St. Louis, Mo.

Drop Forgings. Billings & Spencer Co. See adv., p. 405.

Common Sense Dry Kiln. Adapted to drying of all material where kiln, etc., drying houses are used. See p. 405.

The Sweetland Chuck. See illus. adv., p. 406.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Also manufacturers of Soloman's Parallel Vise, Taylor. Stiles & Co., Riegelsville, N. J.

Electric Lights.—Thomson Houston System of the Arc type. Estimates given and contracts made. 631 Arch, Phil.

"Abbe" Bolt Forging Machines and "Palmer" Power Hammers a specialty. Forsaith & Co., Manchester, N. H.

List 28, describing 3,600 new and second-hand Machines, now ready for distribution. Send stamp for same. S. C. Forsaith & Co., Manchester, N. H., and N. Y. city.

Draughtsman's Sensitive Paper. T. H. McCollin, Phila., Pa.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 388.

Steam Pumps. See adv. Smith, Vaile & Co., p. 388.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, polishing compositions, etc. Complete outfit for plating, etc. Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Small articles in sheet or cast brass made on contract. Send models for estimates to H. C. Goodrich, 66 to 72 Ogden Place, Chicago, Ill.

Latest Improved Diamond Drills. Send for circular to M. C. Bullock Mfg. Co., 80 to 88 Market St., Chicago, Ill.

First Class Engine Lathes, 20 inch swing, 8 foot bed, now ready. F. C. & A. E. Rowland, New Haven, Conn.

Ice Making Machines and Machines for Cooling Breweries, etc. Pictet Artificial Ice Co. (Limited), 142 Greenwich Street. P. O. Box 3083, New York city.

Agents Wanted.—None but intelligent and energetic need apply. Must furnish good recommendations, or no notice will be taken of applications. Exclusive territory given. Agents are now making from $10 to $15 a day. Address, for terms, The Infallible Coin Scale Co., 267 Broadway, New York city.

Improved Skinner Portable Engines. Erie, Pa.

Jas. F. Hotchkiss, 84 John St., N. Y.: Send me your *free* book entitled "How to Keep Boilers Clean," containing useful information for steam users & engineers. (Forward above by postal or letter; mention this paper.)

Steel Stamps and Pattern Letters. The best made. J. F. W. Dorman, 21 German St., Baltimore. Catalogue free.

Machinery for Light Manufacturing, on hand and built to order. E. E. Garvin & Co., 139 Center St., N. Y.

For Power & Economy, Alcott's Turbine, Mt. Holly, N. J.

Presses & Dies (fruit cans) Ayar Mach. Wks., Salem, N. J.

Wood-Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

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Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

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(1) D. A. O. asks: 1. What will be the disadvantage, if any, in using a 15 horse power engine with a 10 horse power boiler, provided not more than 6 or 8 horse power is required? A. There will be a greater loss from radiation and condensation in the larger engine than in one exactly adapted to its work. 2. If 50 pounds steam in 10 horse power boiler will give 8 horse power with 10 horse power engine, what steam with same boiler will be required to give 8 horse power with a 15 horse power engine? A. This will depend upon the relative diameter of cylinders. 3. What will be the difference in fuel required? In how deep a well can a steam jet be successfully used, and what is the best method of raising water from a well 60 feet deep, to supply a steam boiler? A. A steam injector can only be relied upon to raise water 10 or 15 feet. A pump would be a necessity.

(2) H. M. F. writes: What do you think of the following receipt as a gray hair restorer? Take a quantity of black tea and boil down strong, and then, placing a large tenpenny nail within the tea fluid, cork all in a bottle, and use once a week. This remedy is said to supply the "iron" to the hair which is lost and return it to its original color, dark. Do you think this remedy will in time destroy the hair? I am afraid it might cause baldness. A. Tea contains tannin, and this in connection with iron salts produces ink. Ink dyes gray hair black (temporarily), but possesses no value as an invigorator or restorer of gray hair. See "Hygiene of the Hair," by Dr. Erasmus Wilson, in SUPPLEMENT, No. 102.

[OFFICIAL.]

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[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 261 Broadway, corner of Warren Street, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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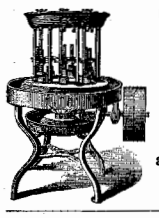

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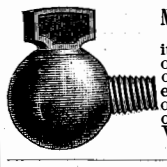

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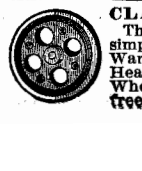
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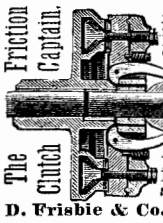

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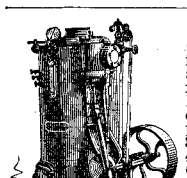

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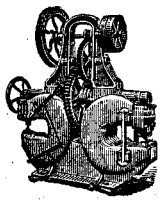

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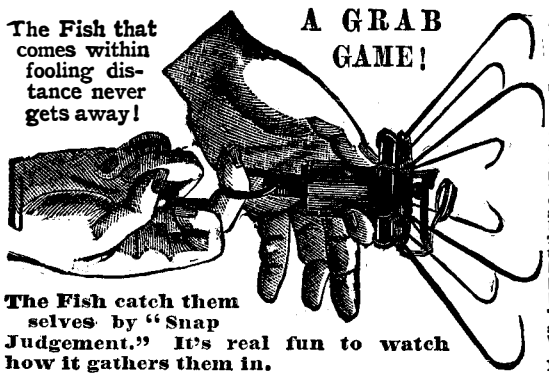

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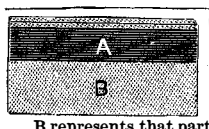

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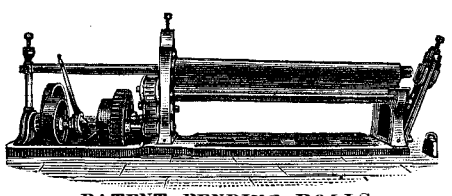

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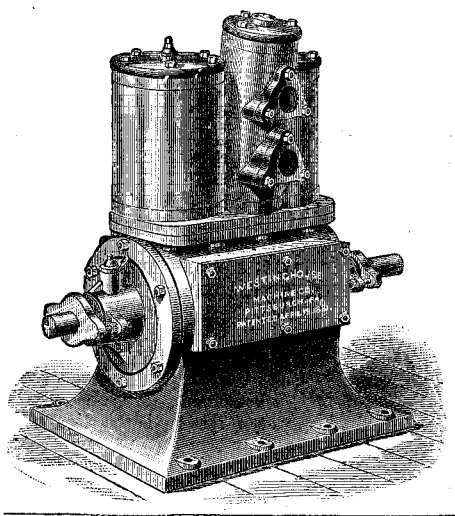

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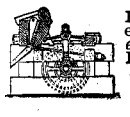

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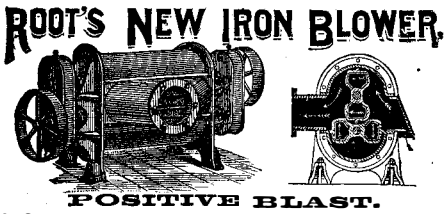

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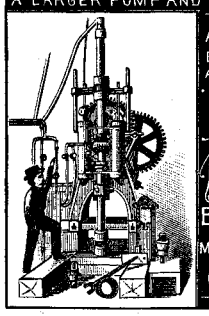

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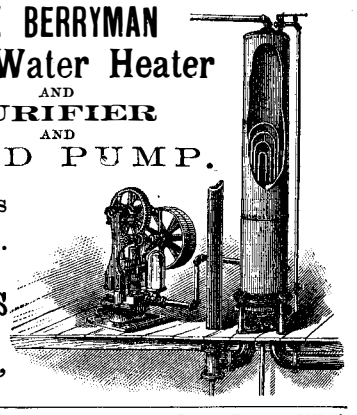

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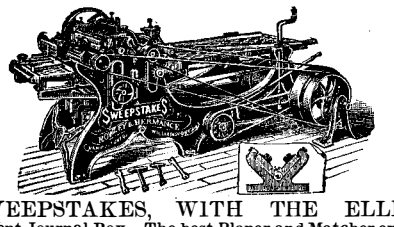

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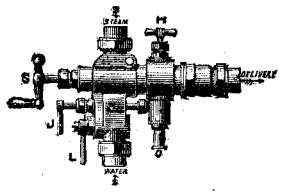

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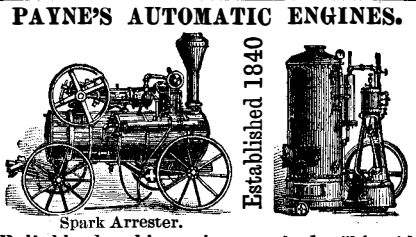

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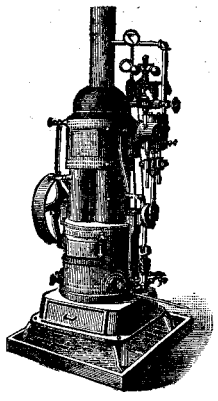

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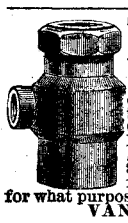

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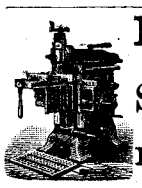

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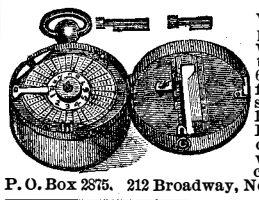

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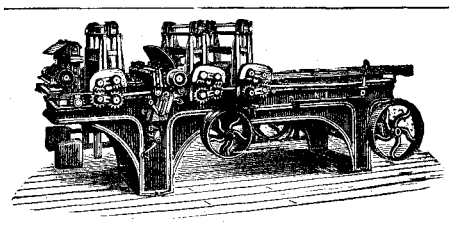

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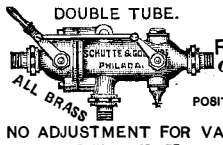

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